American

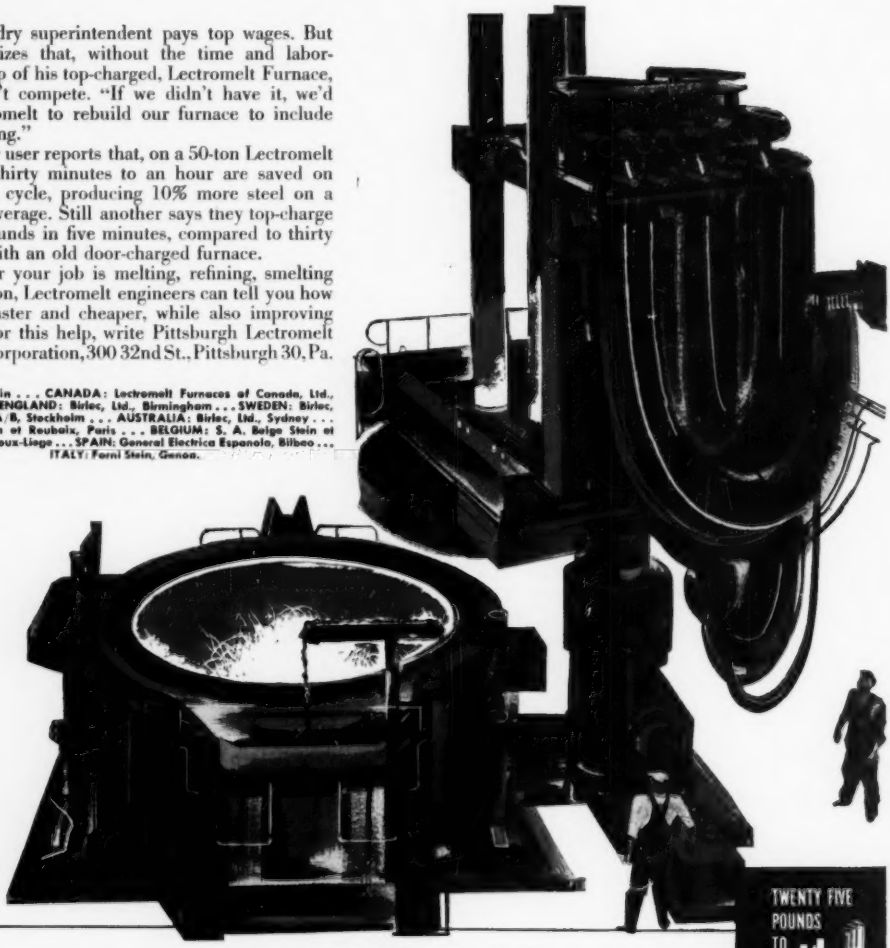
"I'd need labor at 40¢ an hour if we didn't have top charging on our furnace"

This foundry superintendent pays top wages. But he recognizes that, without the time and labor-saving help of his top-charged, Lectromelt Furnace, he couldn't compete. "If we didn't have it, we'd ask Lectromelt to rebuild our furnace to include top charging."

Another user reports that, on a 50-ton Lectromelt Furnace, thirty minutes to an hour are saved on a six-hour cycle, producing 10% more steel on a monthly average. Still another says they top-charge 12,000 pounds in five minutes, compared to thirty minutes with an old door-charged furnace.

Whether your job is melting, refining, smelting or reduction, Lectromelt engineers can tell you how to do it faster and cheaper, while also improving quality. For this help, write Pittsburgh Lectromelt Furnace Corporation, 300 32nd St., Pittsburgh 30, Pa.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . SWEDEN: Birlec, Elektrougnar A/B, Stockholm . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa.



WHEN YOU MELT... MOORE RAPID *Lectromelt*

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THE FEDERAL FOUNDRY SUPPLY COMPANY

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The Scientific Flux for Better Melting and Cleaner Iron

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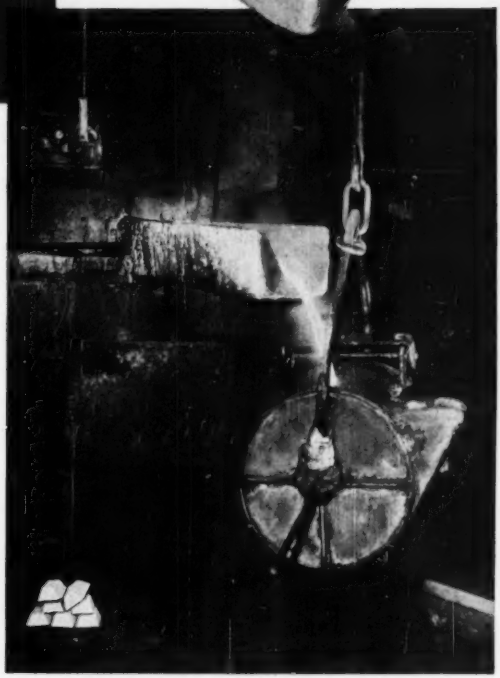
1. **Purite gives 100% fluxing action in the cupola—100% desulphurizing action in the ladle.**
2. **Purite gets to the iron faster—no quicker desulphurizer made.**
3. **Purite is time-tested and proven for unsurpassed desulphurizing uniformity.**
4. **Purite comes in 2 lb. pigs—no weighing or measuring required.**
5. **Purite is 100% pure fused soda ash—you do not pay for inert materials.**
6. **Purite does not crumble—no waste—no dust.**
7. **Purite can be shipped in bulk carloads at substantial savings over bag shipments—is easily stored without deterioration.**

For nearly 30 years there's been no substitute for this successful product. Confirm Purite's many advantages by an actual trial in your own cupolas and ladles. If you need further information, please write today to: Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.



Tapping a modern cupola at the foundry of Mack Trucks, Inc., at New Brunswick, N. J.

Mathieson CHEMICALS

Purite is sold by all leading foundry supply houses in the United States and Canada.

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DECEMBER, 1950

Published in two sections—Section 1

VOLUME XVIII, NUMBER 6

December, 1950

American Foundryman

Official publication of American Foundrymen's Society

Editorial: The Road Ahead: Walter L. Seelbach

Flow Studies Develop Better Gating

A.F.S. Home Fund Tops $50,000

Northwest Regional Foundry Conference

Continuous Filing as Applied to Castings: H. J. Chamberland

1951 Convention Program Taking Shape

Modern Foundry Methods—Cylinder Block Cleaning at Ford Motor Co.

Purdue Metals Casting Conference

Gray Iron—Welding, Joining, Cutting, Part III: C. O. Burgess

The Round Table—Practical Questions and Answers

Michigan Regional Foundry Conference

Core Sag Controlled: Thomas E. Barlow

Better Sulphur Elimination in Basic Open Hearth Melting: John G. Rivet

Gray Iron, Steel, Malleable Galvanizing Characteristics: R. W. Sandelin

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New A.F.S. Members

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Future Chapter Meetings

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New Foundry Products

Foundry Literature

Foundry Firm Facts

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A.F.S. Employment Service

The American Foundrymen's Society is not responsible for statements or opinions advanced by authors of papers in its publication.

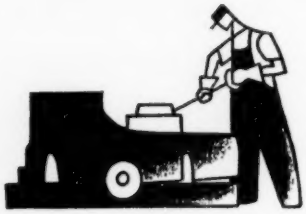
A corner of the cleaning room at the Meadville, Pa., plant of American Brake Shoe Co.'s National Bearing Division, showing continuous removal of particulate matter by means of an overhead exhaust system attached to individual grinding hoods.

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U. S., Canada and Mexico, $5.00 per year; elsewhere, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois. EASTERN REPRESENTATIVE—Warren Thomson Mayers Co., 130 East 61st St., New York. CENTRAL REPRESENTATIVE—Enright & Cleary, 1836 Euclid Ave., Cleveland. MIDWESTERN REPRESENTATIVE—H. Thorpe Covington Co., 677 N. Michigan Ave., Chicago.

BETTER CASTINGS AND LOWER SCRAP LOSSES

NOW ON THE JOB AT GENERAL ELECTRIC

The stator frame casting shown here is an important member of the line of castings turned out by General Electric at its River Works Foundry in West Lynn, Mass. This stator frame must be cast with an almost perfect finish and maximum detail, yet a reasonable cost must be maintained. SAND-MEX is added to the molding sand at the River Works Foundry and helps produce top-quality frame castings. SAND-MEX will help you cut scrap losses and turn out better castings. Why not get all the facts about SAND-MEX, the ideal sand conditioner.



- **SAND-MEX** gives better flowability and makes castings truer to pattern.
- **SAND-MEX** helps eliminate surface defects . . . saves time and money in the cleaning room.
- **SAND-MEX** enables sand to run freer in the hopper and chute . . . speeds molding time.
- **SAND-MEX** assures better collapsibility with less dust at shakeout.
- **SAND-MEX** mixes readily with other ingredients in the sand without extra mulling . . . gives equally good results in natural bonded or synthetic sands.
- **SAND-MEX** is permanent, does not burn out . . . only new sand is treated.

We invite you to consult us regarding your molding sand and casting problems. The facilities of our new, greatly enlarged laboratories are at your disposal. Our experienced engineering staff can make recommendations that will save time and money in your operations. Write us today for the full story on SAND-MEX *and other Mexican Graphite products for your foundry.*

THE UNITED STATES

WITH SAND-MEX®

RIVER WORKS FOUNDRY

CAST WITHOUT SAND-MEX—General Electric stator frame casting, weighing 86 pounds. This frame was cast from molding sand that did not contain SAND-MEX. Note the generally rough appearance and the burned-in areas.

CAST WITH SAND-MEX—Another stator frame casting made from the same pattern. In this casting, 1% SAND-MEX was used in the molding sand. The obvious difference between the two castings tells the SAND-MEX story.

143

GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

CAST IN NICKEL-CHROMIUM IRON, by the Atlantic Foundry Company of Akron, Ohio, this lead melting pot is used in a large rubber plant. It is subjected to temperatures ranging from 620° to 950° F. 24 hours per day. The pot has an inside diameter of 81", is 42" deep and weighs 7,520 lbs.

Scaling...distortion...thermal shock ...resisted by *NICKEL CAST IRON*

To assure long service life, this giant lead melting pot was produced in a cast iron containing 1.75% nickel and 0.75% chromium.

This and similar compositions have shown marked superiority to unalloyed iron in applications that call for resistance to destructive effects of moderately high temperatures.

Hundreds of progressive foundries now use nickel to secure these basic advantages:

IN THE FOUNDRY—Nickel aids the progressive foundry to meet high mechanical property specifications. It is employed in the production of engineering cast irons because it strengthens the pearlitic matrix of the iron, produces finer and more highly dispersed graphite and discourages the formation or retention of hard carbide particles.

IN THE MACHINE SHOP—Nickel cast irons provide readily machinable castings that take a smooth finish because of their improved structure and uniformity, particularly where changes in cross-section introduce difficulties and losses with unalloyed irons.

IN SERVICE—Nickel cast irons are strong and pressure-tight, thereby eliminating a frequent source of trouble in pumps, valves, pipes and fittings.

EMBLEM OF INCO SERVICE

Because of unusually heavy industrial and defense demand, rationing of nickel has been in force since July 1st. However, we believe that dissemination of technical data and service experience can help promote the intelligent utilization of critical materials, so essential in these times. We shall, therefore, continue to issue information on new developments and user experience with nickel-containing materials.

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"That's like making a casting without

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With *all 10* of these important features for maximum foundry efficiency — Uniformity • Concentrated form • No obnoxious odor • No seepage • No crusting of green mix • Clean working • Wide temperature baking range • Polymerized formulation • Minimum gas • Ample collapsibility

Our engineers are always ready to help you. Write us about your core oil problem.

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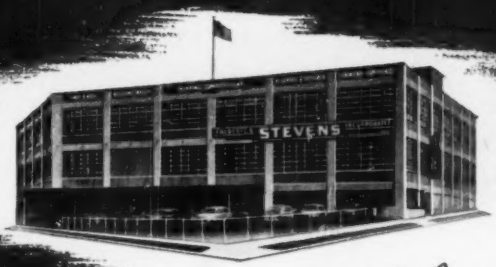

Best Wishes for a Happy Holiday and Prosperous New Year

OUR 68TH CHRISTMAS SEASON FINDS STEVENS STILL SELLING THE BEST IN FOUNDRY FACINGS AND SUPPLIES

Since 1883 Frederic B. Stevens, Inc., has worked to help foundrymen improve castings through *better* facings and supplies. That's why experienced foundrymen have continued through the years to regard Stevens as a dependable source of supply for "EVERYTHING FOR A FOUNDRY." They know when they order from Stevens they can depend on the utmost efficiency and absolute dependability of both product and service.

Whatever your foundry operations involve—you will find it will pay off in lower costs and greater production to consult Frederic B. Stevens, Inc. Your nearby Stevens representative will show you how our vast experience and technical facilities can quickly give you the right answer to any foundry problem—without obligation on your part. Yes, if it's anything for a foundry—from core wash to "know-how"—Stevens can deliver.

EVERYTHING FOR A FOUNDRY

FREDERIC B. **STEVENS** INCORPORATED

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Meets Your Most Exacting Specifications

The Uniformity YOU Want . . .
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Our special processing, large production capacity and unlimited supply of raw material enable us to give you prompt, year 'round shipment of uniform foundry sand.

CLAYTON SILICA is high quality Silica Sand from the St. Peter sandstone family. Clayton Silica is carefully graded, screened and dried, and will meet your exact foundry needs. AFS fineness from 55 to 85.

Chemical analysis, sintering tests, and screen analysis available upon request. Wire, write or phone for full details.

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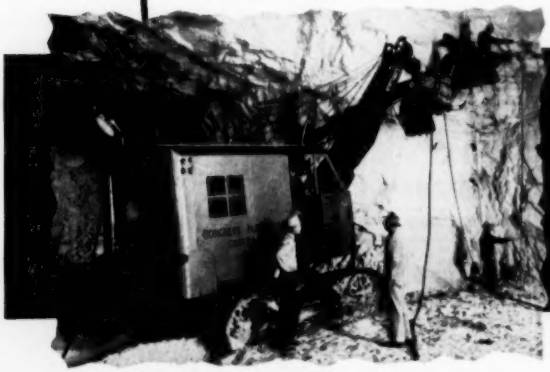

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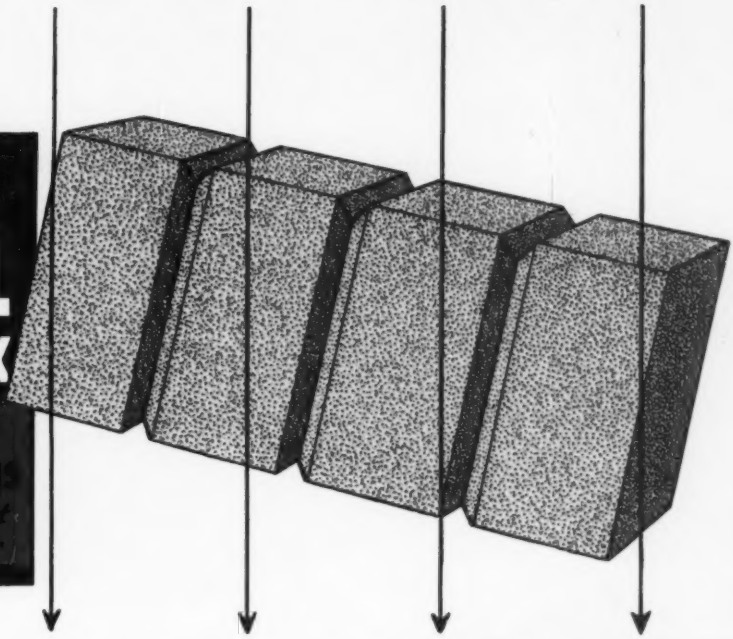
Produces Better Castings and More Efficient Cupola Operation.



CLEANSES IRON AND INCREASES FLUIDITY

REDUCES SULPHUR, KEEPS SLAG FLUID

MAKES CASTINGS SOUNDER, CLEANER

REDUCES CUPOLA MAINTE-NANCE

EASIEST TO USE BECAUSE OF PRE-MEASURED SCORED BRICK FORM

All you do is lift it out of container and toss it into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

● Leading gray iron foundries, and malleable foundries with cupola operation, say the investment in Famous Cornell Cupola Flux pays big dividends by giving their castings a better start and minimizing rejects.

Chilled sides, hollow centers and hard spots in castings are greatly reduced. Machining is easier and smoother.

Cupola maintenance is reduced because Famous Cornell Cupola Flux forms a glazed or vitrified surface on brick or stone over and above the melting zone, greatly reducing erosion and bridging over and prolonging the periods between patching and replacement.

Write for Bulletin 46-B

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

The CLEVELAND FLUX Co.

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Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum Flux Since 1918

FAMOUS FLUXES
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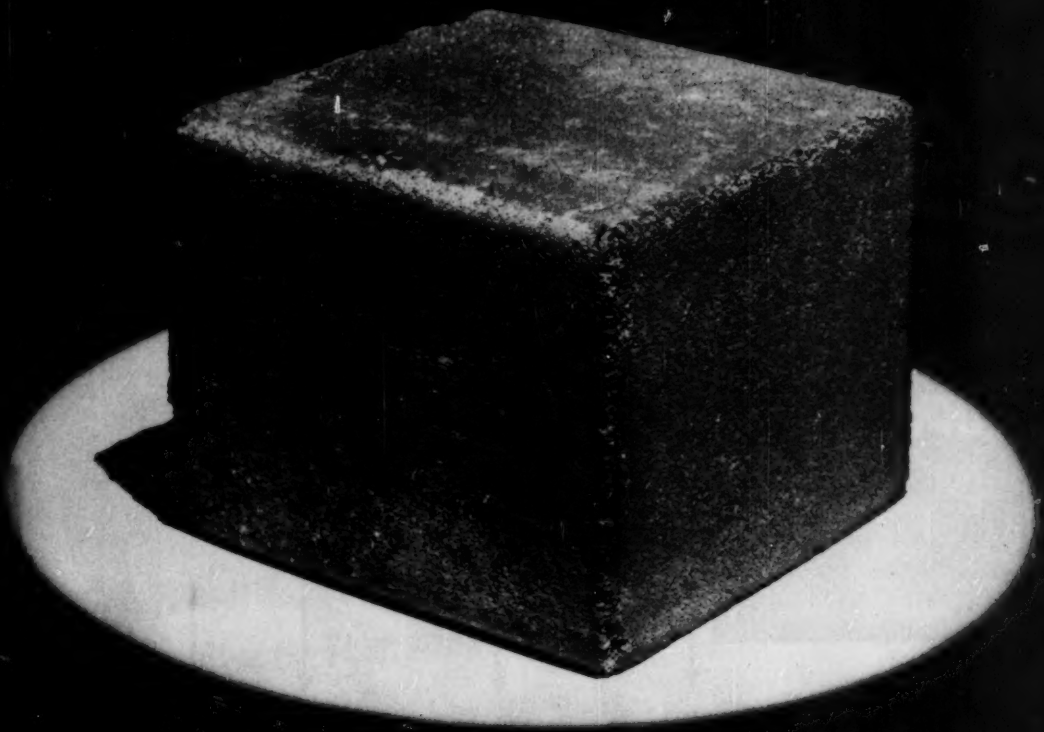
Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.



FERROCARBO Briquettes are manufactured under U. S. Patents 2,119,521 and 2,497,745. The process of making cast iron through utilization of silicon carbide is registered under U. S. Patent 2,020,171.

FERROCARBO Briquettes by CARBORUNDUM

TRADE MARK

IMPROVING MACHINABILITY

FERROCARBO Briquettes are a specially processed type of silicon carbide...used effectively as a cupola deoxidizer.

Machining speeds on castings from iron thus treated have been increased while tool life has been extended substantially. Our distributors welcome the opportunity to demonstrate these and other advantages in detail.

THE CARBORUNDUM COMPANY, Bonded Products and Abrasive Grain Division, Niagara Falls, New York

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Courtesy Combustion Engineering-Superheater Inc.

to be sure COMBUSTION-SUPERHEATER uses **FEDERATED** BRONZE INGOT

When a difficult bronze casting problem faced Combustion Engineering-Superheater Inc., they turned to Federated Metals and the Christensen and Olsen Foundry in Chicago.

C & O and Federated solved the problem. The castings... parts of an Exhaust Steam Injector Body which must be pressure tight and virtually perfect... are made by C & O. Federated copper-base alloys are used because metal of consistent quality is demanded.

Federated metals and Federated service are at your command, too, whenever you have a foundry problem.

See Federated first for any non-ferrous alloy... aluminum, magnesium and copper-base foundry metals; solders; bearing metals; and fabricated lead products.

Federated Metals Division

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1 GET MORE GREEN STRENGTH

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3 PRODUCE FINER DETAIL

4 GET EASY BURN-OUT COLLAPSIBILITY

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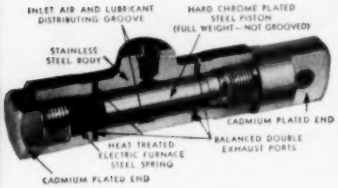
STYLE "A" MATCH PLATE VIBRATORS


INLET AIR AND LUBRICANT DISTRIBUTING GROOVE
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STAINLESS STEEL BODY
CADMIUM PLATED END
BALANCED DOUBLE EXHAUST PORTS
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CADMIUM PLATED END

Combine

Light weight
Rugged Construction
and Long Service

Cannon Light Weight Style "A" Vibrators are unsurpassed for long life, efficiency, and trouble-free operation. The pistons are hard chrome plated to prevent rusting and friction, and deliver the impact of their full weight against both heat treated ends.

Ingenious distribution of intake air and lubricant around the entire circumference of the piston, and balanced double exhaust porting, permits the piston to "float", eliminating "drag" on the body and reducing wear. These Vibrators maintain their peak efficiency longer and require a minimum of repairs.

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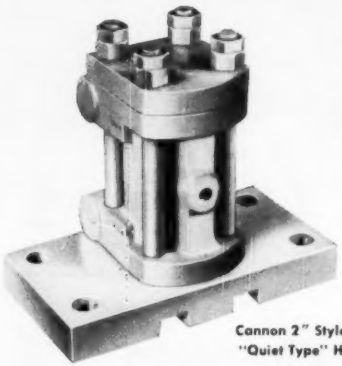
CANNON "*Quiet Type*"

Pat. Pend.

The First *Completely Dependable Long Lasting* Pneumatic Vibrator For Shakeouts, Bins, Hoppers, Core and Molding Machines



Cannon 2" Style EM.
"Quiet Type" Hopper Vibrator.

- Produces Greater Vibration
- Reduces Noise
- Prevents Bolt Breakage
- Cuts Repair Costs

● Built with *heavier pistons* and *longer strokes* than can be used in heavy duty impact type vibrators without breakage, Cannon "Quiet-Type" Vibrators have outstanding performance records on key equipment in some of the country's largest and best known foundries. There is no impact of the piston on either end—no metal to metal pounding—no springs—no ear-splitting noise. Users report that the breakage of bolts and end plates previously incurred with impact type vibrators is eliminated. Maintenance is practically nil.

Furnished in 1" to 4" sizes. Interchangeable with any impact type bolted vibrator. Try Cannon "Quiet-Type" vibrators on the shakeouts, bins, hoppers, and core and molding machines in *your* plant and *see for yourself*. Satisfactory performance *guaranteed*. Write for complete information *Today!*

Write for Prices and Catalog *Today!*

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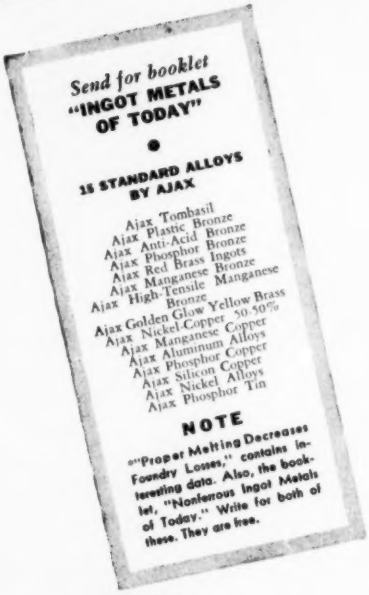
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3. Is non-reactive with molten metal.
4. Will not pit nor etch metal patterns and core boxes.
5. Will not contaminate nor reduce fusion point of core and molding sands.

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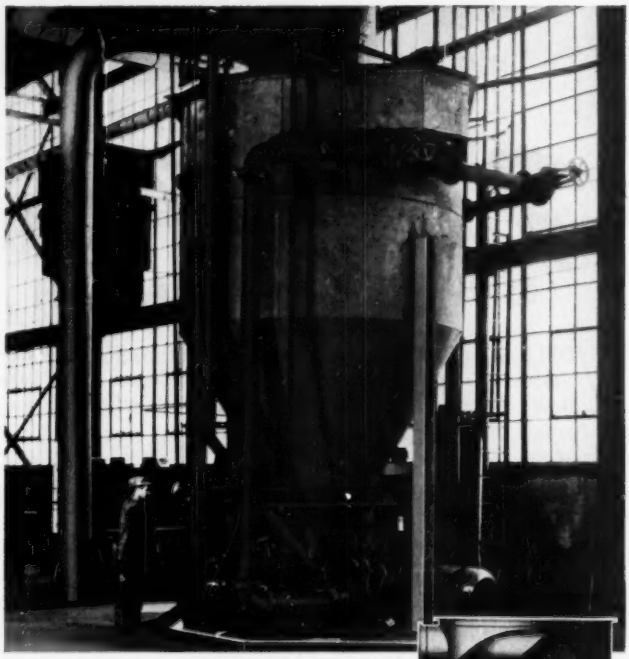

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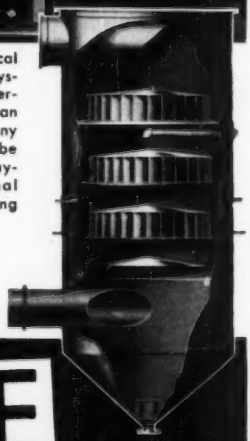

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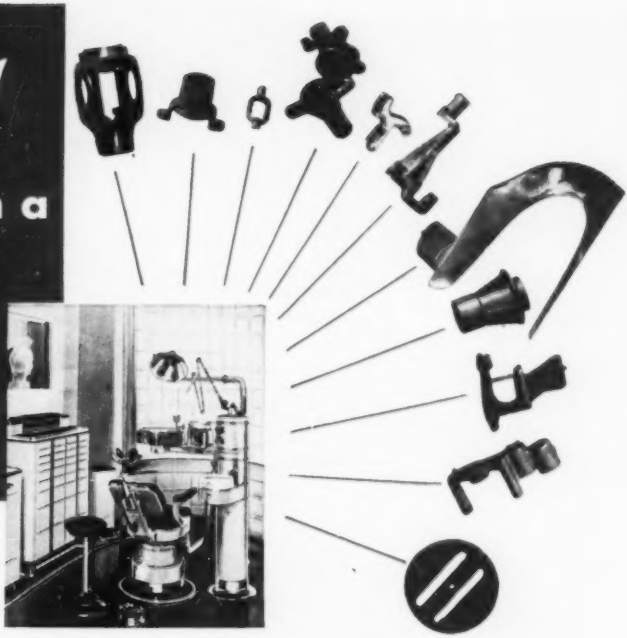

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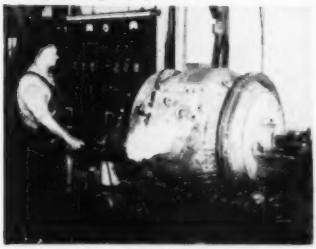

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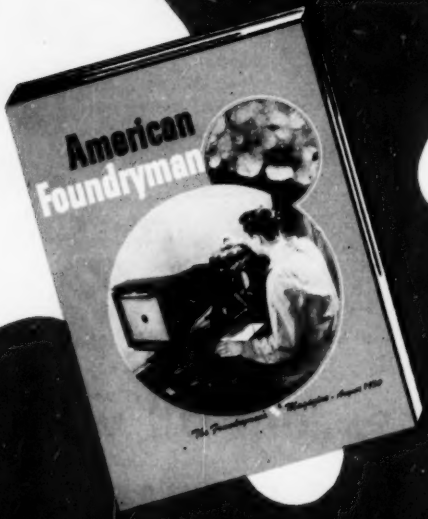

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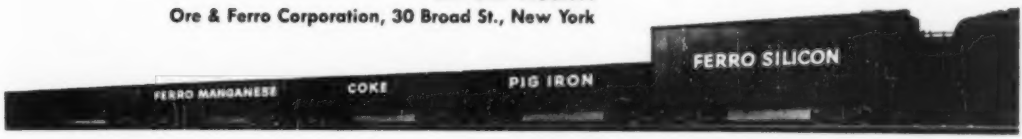

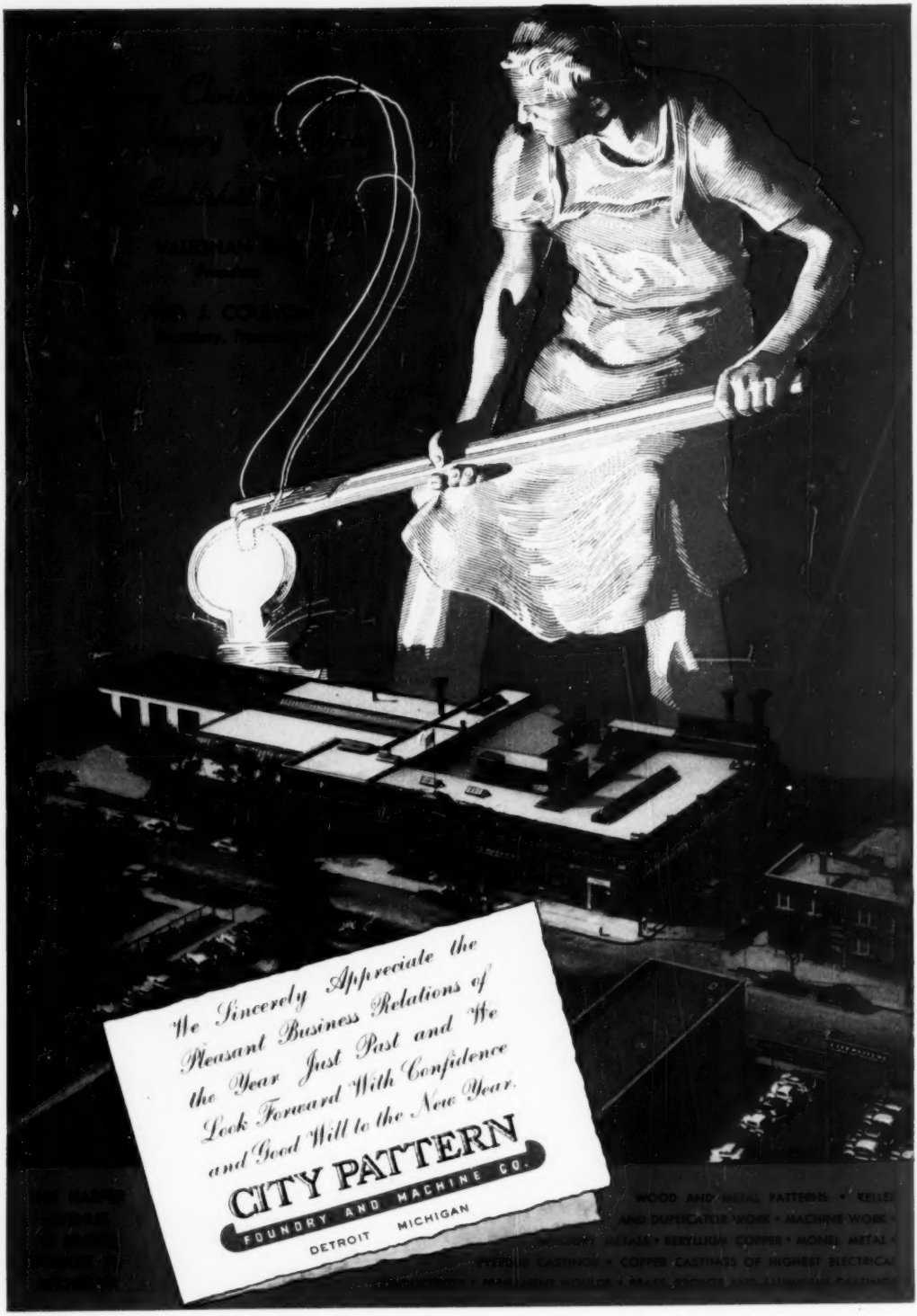
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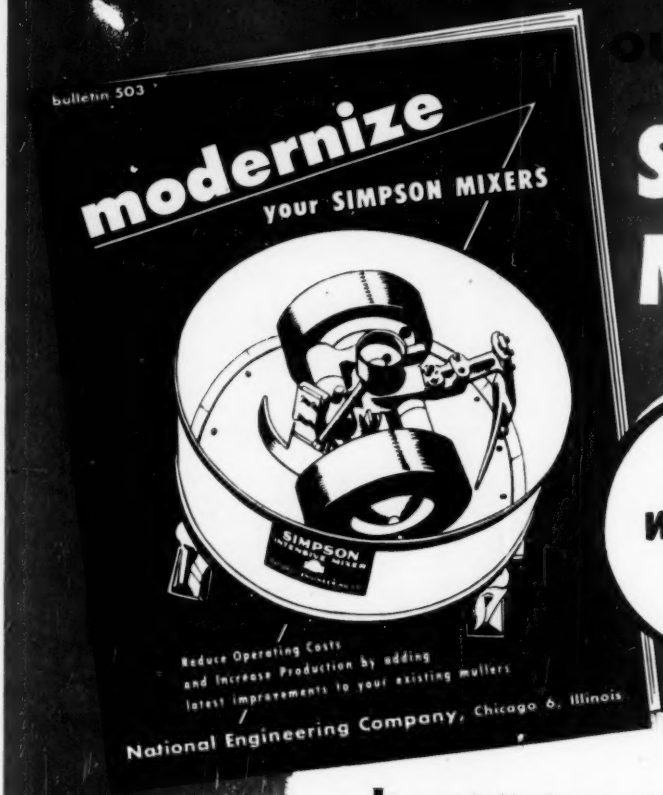

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THE ROAD AHEAD

THE ROAD AHEAD has just two forks, many realists believe. One fork leads to a third world war, the other fork to a North America that is a virtual armed camp—armed to the teeth and prepared for any emergency—for many years to come. We do not like it a bit, and there are some who still refuse to believe it necessary; yet there does not seem to be much choice, as long as we still have a choice.

No matter which road we travel, it means tremendous industrial production. And since United States industry is already operating at a peak, it means, without doubt, that production will have to establish new standards and new goals. Since all industry is dependent on castings, the foundries of North America probably will have to meet greater demands for castings than we have ever met before.

What should we foundrymen do about it? First of all, we must take advantage of every bit of information dealing with better production methods and quality cast products. This means—use your American Foundrymen's Society!

This Society, in over 54 years, has developed a tremendous library of technical and practical information on foundry practice. It publishes annually a great deal of new material in the form of books, pamphlets, research reports, and the Society's monthly magazine AMERICAN FOUNDRYMAN. It offers additional valuable data at meetings of its 40 chapters, at regional foundry conferences, in committee work, and at A.F.S. Conventions. The information is available to everyone.

Failure to keep informed is the most expensive policy a businessman can pursue.

The tremendous production foreseen has a real danger for foundries that do not have an adequate cost system. A busy shop can go broke as quickly as an empty shop—and more easily, in fact, if costs are not known. The necessary information is available, but for years this Society and others have preached "know-your-costs" to many deaf foundry ears.

Another step along the road ahead is the old problem of foundry training. Already more and more women are entering our industrial plants; we will be losing more and more young men to the armed services, men who will have to be replaced. This creates several problems: First, we must have information and the means available to train the new people properly and promptly. Second, we must simplify foundry jobs more and more, through mechanization, time study, and the like, to make production workers in as short a time as possible. And third, we must pay more attention to working conditions or prospective employees will go to work somewhere else.

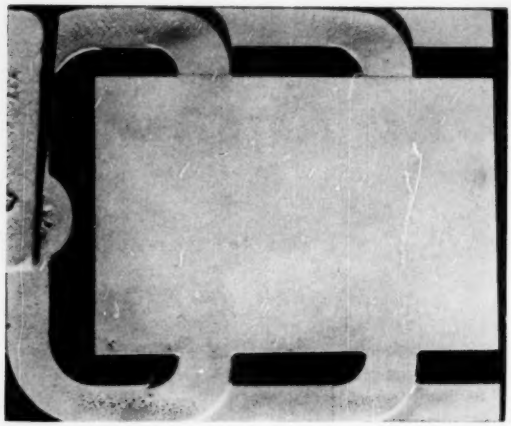
On the last point, A.F.S. has already accepted the obligation to establish a strong Safety and Hygiene Program to develop recommended practices for safe and efficient and healthful foundry operations. We have added the words "Air Pollution" to this program, for that problem is receiving more and more attention. A number of A.F.S. codes of recommended practice are already available and have been used by foundries all over the world. The need is industry-wide, and soon we shall seek industry-wide support.

We look forward to high production for some time to come—and with all its headaches. But one thing we are sure of, whichever road we take, in the words of the merchant marine seaman in the last war, "We're guys they can't get on without!"

Walter L. Seelbach

WALTER L. SEELBACH
National Vice-President
AMERICAN FOUNDRYMEN'S SOCIETY

This month's editorial is based on a talk made by A.F.S. Vice-President Walter L. Seelbach before a dinner meeting at the 1950 All-Canadian Foundry Conference. Mr. Seelbach is a Past National Director of the American Foundrymen's Society (1935-37) and has served as president of the Ohio Foundrymen's Association (1926) and president of the Gray Iron Founders' Society (1943-45). A graduate of Case Institute of Technology in 1910, he joined Forest City Foundries Co., Cleveland, that year, subsequently becoming secretary-treasurer of the company. He was vice-president when he resigned in 1946 to head his own organization, Superior Foundry Co., Cleveland. In addition to the honors accorded him by the American Foundrymen's Society and the Gray Iron Founders' Society, Mr. Seelbach has been president of the Associated Industries of Cleveland, chairman of the Foundry Educational Foundation's Case Institute Advisory Committee and its Cleveland area campaign, and is chairman of the Sub-Committee on Gray Iron, Foundry Industry Committee to the Munitions Board of the National Military Establishment. He has for many years been active in American Foundrymen's Society foundry cost methods work.



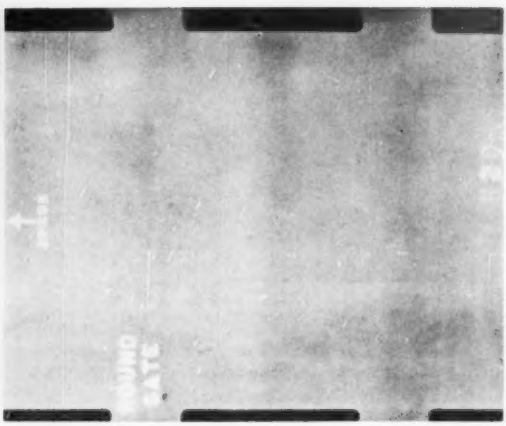


Fig. 1 (above left)—Cope of sand-blasted casting made in sand from high-drossing aluminum-10 per cent magnesium alloy. Gating system according to Fig. 3.

Fig. 2 (above right)—Radiograph of casting shown at left shows substantial freedom from internal defects and is typical of many castings made by this method.

FLOW STUDIES DEVELOP BETTER GATING

NEW IDEAS in gating and confirmation of established practices continue to develop out of the Aluminum and Magnesium Division's research project on fluid flow. One of the latest recommendations for castings having low height is to place the runner in the drag and the gates and mold cavity in the cope. All the work to date has been done on flat castings.

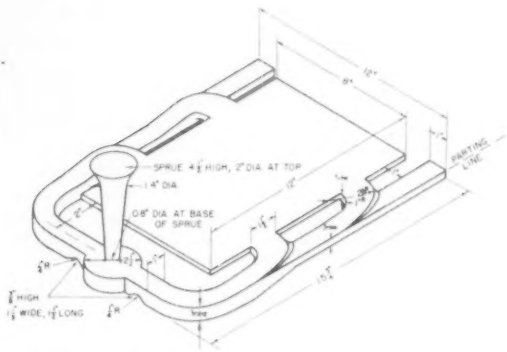
Using transparent plastic molds and water (which has a kinematic viscosity similar to that of aluminum and magnesium melts) as research tools, K. Grube and L. W. Eastwood of Battelle Memorial Institute, Columbus, Ohio, have produced a second film, summing up results of work conducted between October 1, 1947 and June 1, 1950. The new film—in color and sound—picks up where the original black and white, silent film ends and carries gating principles a step farther in the direction of perfection and standardization.

Briefed here, the new film shows the development of pouring box, sprue, and horizontal runner and gate systems to provide castings of maximum external and internal soundness. The series of experiments was photographed at normal speeds and certain phases of the work were recorded in slow motion. Confirmation of the workability of the gating ideas developed was obtained through pouring castings of Wood's metal in transparent molds and finally aluminum—10 per cent magnesium alloy in sand molds.

General principles given in this year's Convention report on fluid flow (references at end of article) follow. Figure 3 illustrates the recommended gating system (transparent mold is shown in Fig. 8) and Fig. 1 and 2 show a casting typical of many made with such a system. Dimensions can be scaled up or down to suit casting size.

The pouring technique and gating design should

Fig. 3 (below)—Recommended gating system for plate-type castings. Mold cavity and gates are in cope, runner in drag. Runner collect dross on cope side.



be such that the gating system can be completely and quickly filled before any liquid enters the mold cavity, and such that it can be kept full during the entire pour. Proper pouring technique includes such old standard rules as (1) keep the pouring lip low and close to the mold, (2) skim the metal well, and (3) fill sprue or pouring box quickly and keep it full.

If the flow channel can be filled quickly and kept full, gas entrainment from the vortex as metal first enters the sprue, aspiration through the mold wall, and gas entrapped during the initial part of the pour can be avoided or minimized. To use this general principle, it is necessary to avoid abrupt changes in direction of flow or in cross-sectional area of the flow channel. The one location where abrupt changes in direction and cross-sectional area are necessary and

desirable is in the portion of the runner under and adjacent to the sprue.

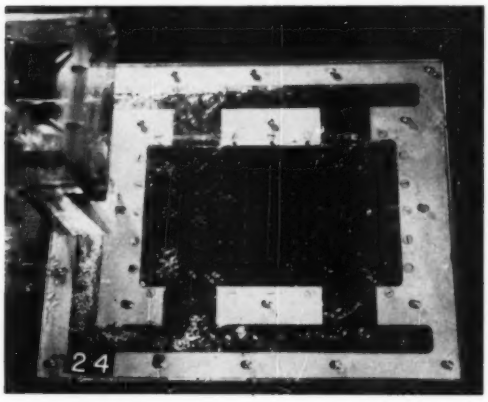
The juncture of pouring box and sprue, as shown in the first A.F.S. fluid flow film, should be rounded to avoid separation of the metal from the sprue with resultant entrainment of air. A tapered sprue with the small end at the bottom keeps the sprue full and prevents aspiration of air through the mold wall. Air thus introduced into the metal stream is carried into the mold cavity. Size of the bottom of the sprue should be as small as possible and just large enough to permit pouring rates that eliminate misruns without the use of high pouring temperatures.

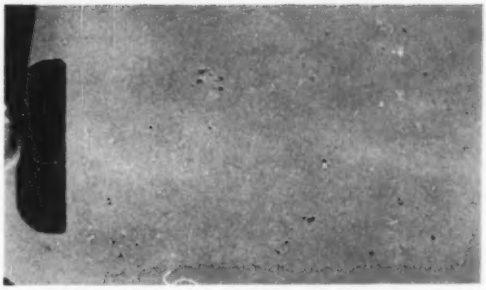
Reducing Velocity of Flow

The liquid poured into the mold has its highest velocity as it emerges from the bottom of the sprue. The principal problem of gating involves the reduction of this velocity of flow in the flow channel between the sprue bottom and the mold cavity so that the metal does not enter the cavity too violently. Velocity can be reduced to one-fourth or one-sixth by enlarging the runner under the sprue and putting streamlined restrictions in the runner on either side of the enlargement. The streamlined restrictions used during the investigation were completely satisfactory for only one combination of sprue and runner dimensions worked with so far. Use of restrictions in the runner on either side of the enlargement under the sprue is recommended.

A triangular restriction at right angles to the runner and immediately below the sprue was successful for one specific set of sprue and runner dimensions but is not a general solution to sprue-base design.

Design of gates and runner between sprue base and mold cavity is simple because abrupt changes in direction and in cross-sectional area of the flow channel can be fairly readily avoided or reduced in magnitude. To avoid abrupt changes in direction of flow, corners of runners should be rounded on as large a radius as possible and the juncture of gates and runners should also be rounded on the largest possible radius on the sprue side. Metal required to flow around sharp corners and make abrupt changes in direction of flow will aspirate air through the mold wall and will not





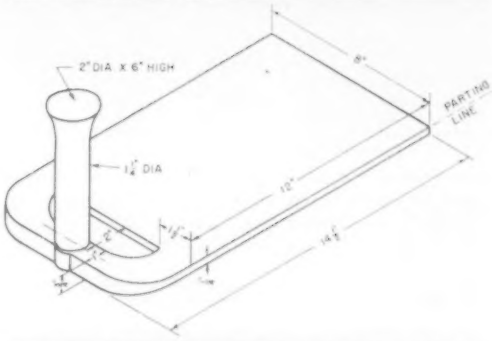


Fig. 4 (top)—Extreme unsoundness in this casting is direct result of faulty pouring and gating technique. Large untapered sprue and runner leading directly into casting are sometimes used. Defects are typical.

Fig. 5 (middle)—Simple gating system representative of Mold A makes no provision for eliminating air entrainment, air or mold gas aspiration, or reduction in flow velocity, produces casting shown in Fig. 4 and 6.

Fig. 6 (directly above)—Radiograph of casting illustrated in Fig. 4 shows that, in addition to severe unsoundness of cope surface, many areas of dross occur within the casting. Gating system is inadequate.

Fig. 7 (left)—Water casting being poured in plastic mold with gating system typical of Mold B. Poor pouring technique allows vortex to form in sprue. Air bubbles carried into mold cavity represent damaged liquid metal. Test castings showed cope surface and internal defects midway between good and bad.

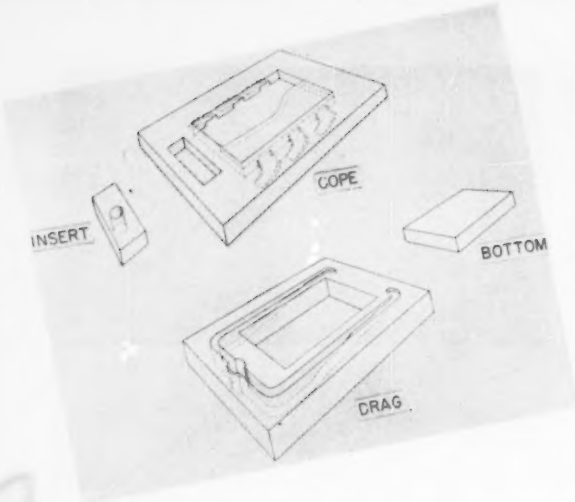


Fig. 8—Design of Mold C, essentially as recommended for foundry use as result of A.F.S. research project. Runners between sprue and first gate are 2 in. deep, ¾ in. wide. Each gate is ¼ in. deep and 2 in. wide. Cross-sectional area of runner is reduced by gate area, ½ sq. in., as each gate is passed. Compare with Fig. 3.

keep the flow channel full, resulting in air entrainment.

The cross-sectional area of the runner on either side of the sprue between the sprue and first gate should be two to three times the cross-sectional area of the small end of the sprue. The total area of the gates should be equal to or slightly larger than the total cross-sectional area of the runner between the sprue and the first gate. The runner should be reduced in cross-section by the size of the gate as each gate is passed. This keeps the runner full throughout its length and results in uniform distribution of flow through all gates. Failure to reduce the size of the runner results in gates farthest from the sprue carrying most of the metal.

Although other methods may be satisfactory, it is concluded from this investigation that, when the runner is placed in the drag and the gates in the cope, the sprue and runner can be filled before metal enters the mold cavity.

In this stage of the research project, a considerable variation in gating geometry was obtained through the use of a number of sprues of different sizes and shapes. Further variations were obtained by using plastic and modeling clay inserts in runners and gates. Vent holes drilled through the transparent mold over runners and gates, and in the sprues, simulated sand mold porosity at critical points.

Three transparent molds (A, B, and C) illustrated by Fig. 3, 5, and 7, were studied. Molds A and B were also used in the first phase of the investigation. Design of the runner directly under the sprue posed the greatest problem because the liquid at this point has its greatest velocity. It must be retarded with minimum turbulence to avoid aspiration of air and to eliminate a jet effect as the molten metal enters the mold cavity. While the problem can be minimized markedly by reducing the capacity of the gating system, this leads to slow pouring rates with excessively high pouring temperatures, misruns, or both.

Attempts to vary the design of the runner under the sprue with modeling clay showed that one or more difficulties were encountered: (1) The capacity of the gating system was seriously reduced; (2) Air was aspirated in the region of the sprue base; (3) Gas pockets were entrapped at the sprue base and a considerable time was required to wash them from the gating system. Experimental sprue-base designs made in plastic are illustrated in Fig. 11, 12, 13, 14, and 15.

General direction of the project, "Fluid Hydraulics of Light Metal Flow into Molds," sponsored by the American Foundrymen's Society with some financial assistance from Battelle Memorial Institute, is by the Research Committee of the A.F.S. Aluminum and Magnesium Division and Technical Director S. C. Massari. Committee members are: *chairman*, Dr. R. F.

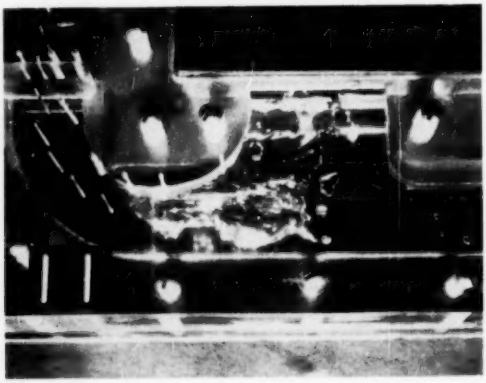


Fig. 9 (above)—Separation of liquid in gate is caused by abrupt twofold increase in cross-sectional area of flow channel. Portions of gas pocket gradually washed into cavity would cause surface and internal defects.

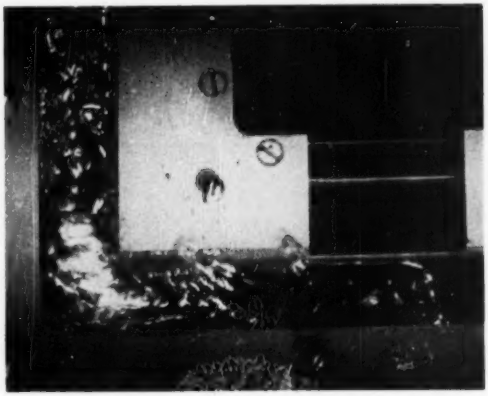


Fig. 10 (right)—Enlargement of slow motion movie frame shows large volume of air, entrapped in Wood's metal due to poor pouring technique and gating design, escaping from surface of stream; demonstrates similarity in behavior of water and molten metal.

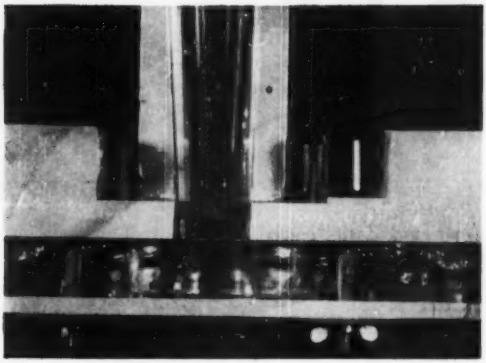


Fig. 11 (left)—Poor gating design with sprue connected to runner to form plain inverted T is shown by severe air aspiration through vent holes in cope over runner.

Fig. 12 (below)—Runner enlarged to 2½ in. in diameter at bottom of sprue eliminates aspiration but traps air bubbles for 8 sec. after pouring starts and reduces capacity of gating system by 18 per cent. Vortex in sprue was eliminated during studies by use of pouring box stopper which was pulled after filling.

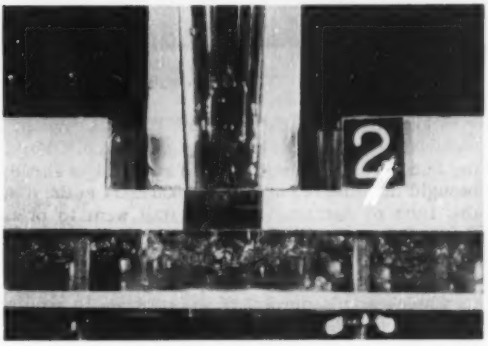


Fig. 13 (immediately below)—Streamlined inserts in runner on each side of enlargement below sprue eliminated entrapped air bubbles in one second, reduced flow 20 per cent below that of runner shown in Fig 12.

Thomson, Research Laboratories Div., General Motors Corp., Detroit; *vice-chairman,* Walter Bonsack, Christiansen Corp., Chicago; Walter J. Klayer, Aluminum Industries, Inc., Cincinnati; C. E. Nelson, Magnesium Div., Dow Chemical Co., Midland, Mich.; T. D. Stay, Reynolds Metals Co., Cleveland; and Walter E. Sicha, Aluminum Co. of America, Cleveland.

Details of the Society's fluid flow research can be found in the two motion pictures available through A.F.S. Headquarters, 616 South Michigan Ave., Chicago 5, Ill., and the following references:

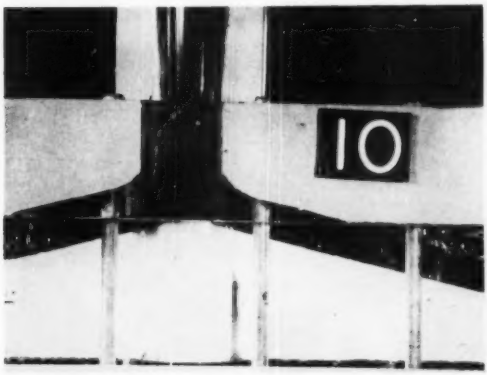
R. E. Swift, J. H. Jackson, and L. W. Eastwood, "A Study of the Principles of Gating," A.F.S. TRANSACTIONS, vol. 57, pp. 76-88 (1949).

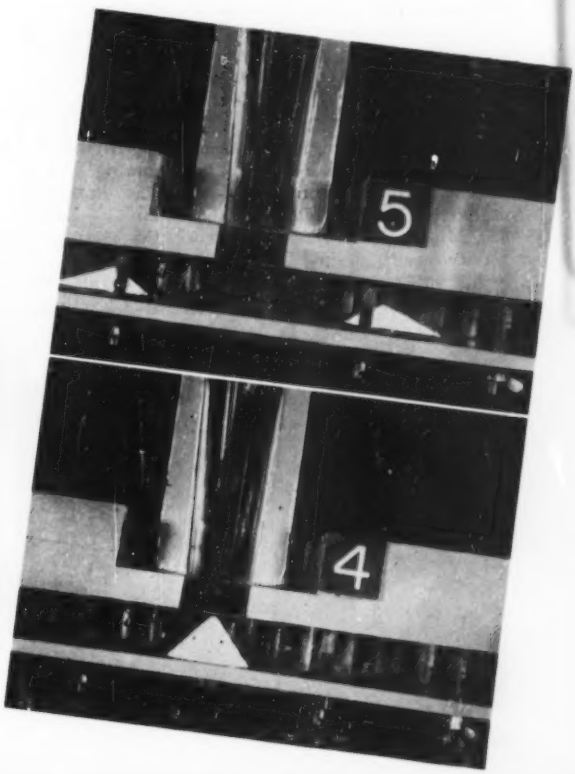
"First Principles of Gating," AMERICAN FOUNDRYMAN, vol. 16, no. 6, December 1949, p. 27.

K. Grube and L. W. Eastwood, "A Study of the Principles of Gating," A.F.S. TRANSACTIONS, vol. 58 pp. 76-107 (1950).

Fig. 14 (below left)—Constricting runner immediately below sprue increases capacity of gates 16 per cent above plain inverted T design but severe aspiration due to high flow velocity makes system impractical.

Fig. 15 (below right)—Sprue base has same enlargement as shown in Fig. 12 but triangular piece improves design and eliminates entrapped air in one second. This design does not aspirate air and has capacity almost identical with design illustrated in Fig. 12.





A.F.S. HOME FUND

FORM PLANNING AND

Ralph J. Teetor

Walton L. Woody

IN RESPONSE to A.F.S. President Walton L. Woody's membership-wide call for support of the A.F.S. Building Fund, a flood of contributions and pledges already brought the fund beyond the $50,000 mark at the time this issue of AMERICAN FOUNDRYMAN went to press. From all over the United States and Canada, from individuals and companies and in amounts large and small, the membership of the Society daily indicates its wholehearted approval of the program to acquire a permanent headquarters for A.F.S.

More Than 300 Contributors

Over 300 separate subscribers have contributed voluntarily and the number of "charter subscribers" to the fund grows day by day. Although the program, announced in the September issue of AMERICAN FOUNDRYMAN, contemplates a period of three years for accumulation of the necessary funds to complete the project, those who have benefited most from the Society's activities over the past 54 years apparently are determined that the entire Fund shall be raised far in advance of 1953.

Form A.F.S. Housing Committee

An A.F.S. Housing Committee, composed entirely of men who have added greatly to the prestige of the Society, has now been formed with Past President Ralph J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., as Chairman. Others who have accepted service on this guiding Committee are:

A.F.S. National President Walton L. Woody, National Malleable and Steel Castings Co., Cleveland.

Past President G. H. Clamer, Ajax Metal Div., H. Kramer & Co., Philadelphia.

Past President E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md.

Past President Marshall Post, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

Past President L. N. Shannon, Stockham Valves & Fittings, Inc., Birmingham, Ala.

Past President H. S. Simpson, National Engineering Co., Chicago.

Past President W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa.

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Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif.

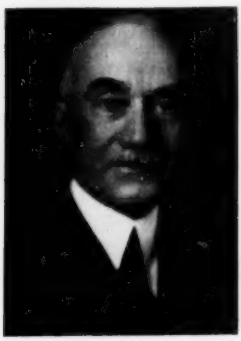
Past Director Frank C. Riecks, Ford Motor Co., Dearborn, Mich.

Past Director L. P. Robinson, Werner G. Smith Div., Archer-Daniels-Midland Co., Cleveland.

Past Director S. D. Russell, Phoenix Iron Works, Oakland, Calif.

This Housing Committee, with both geographical and industrial representation, will be a semi-permanent committee to see the building project through to completion. As previously announced, the committee will constitute a direct advisory group to the Board of Directors. Its decisions will be subject to final approval of the Board. The Housing Committee will maintain closest contact with every step of the project from now on.

G. H. Clamer



E. W. Horlebein

L. N. Shannon

Marshall Post

TOPS $50,000

GUIDANCE COMMITTEE

Splendid support of the membership to date indicates that the original goal of $100,000 undoubtedly will be far exceeded. Contributors who have pledged for a three-year period have now been requested to remit their contributions for the first year, and the entire Building Fund will be maintained intact for disbursement only in accordance with the resolution approved by the Board last July.

Chapters, Alumni Contribute

Many of the A.F.S. Chapters, as well as the Society's "Alumni Group," have contributed generously to the program in spite of a single membership-wide announcement. What the permanent headquarters of the Society will look like, where it will be located, and what it will contain, are still matters for determination by the overall Housing Committee. One thing is certain, however, that the Society's membership and the industry as a whole will successfully complete the job and that the Technical Society of the Metal Castings Industry will have a national headquarters that will materially advance the service and accomplishments of A.F.S. in future years.

LIST OF CONTRIBUTORS

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(Continued on following Page)

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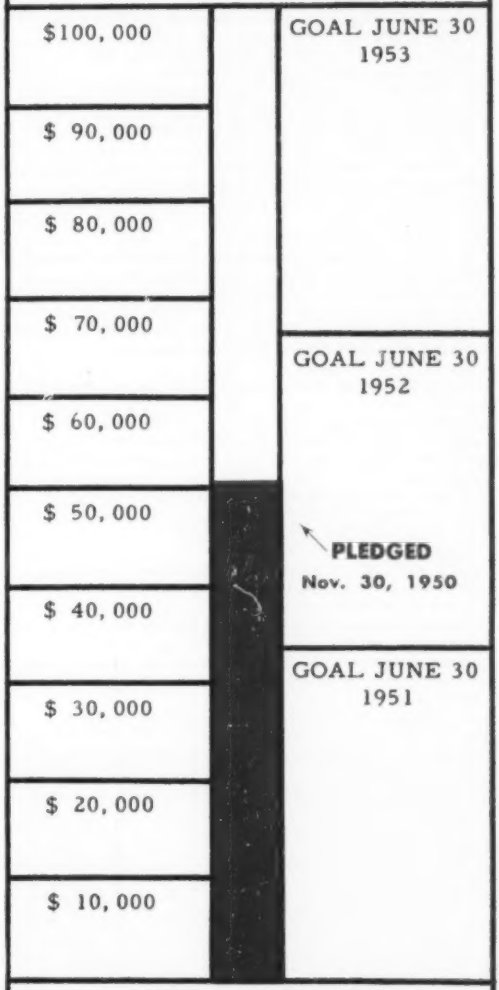
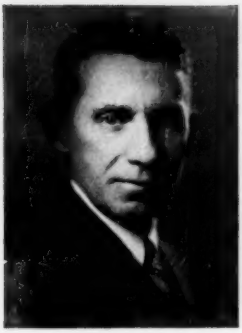


A PROJECT OF THE A.F.S. MEMBERSHIP



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(Continued on Page 40)

E. N. Delahunt

J. L. Wick, Jr.

T. H. Benners, Jr.

F. C. Riecks

NORTHWEST PACIFIC CHAPTERS HOLD FIRST REGIONAL MEETING

PACIFIC NORTHWEST FOUNDRYMEN met October 13 and 14 in Seattle, Wash, for their first regional foundry conference. Attended by 135 foundrymen including delegations from the Northern and Southern California chapters, the Northwest Regional was sponsored by the Washington, Oregon, and British Columbia chapters, the Oregon State College student chapter, and the University of Washington.

The Conference opened at the Gowman Hotel the evening of October 13 with a dinner at which A.F.S. Secretary-Treasurer Wm. W. Maloney spoke on *"What's Ahead for the Foundry Industry."* He was introduced by National Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif. Leon Morel, Morel Foundry Co., Seattle, the other dinner speaker, described production of bronze statuary and municipal and architectural hardware in his talk entitled *"An Artist in Bronze."* Charles M. Anderson, Eagle Foundry Co., Seattle, presided.

Sees Great Production Demand

The years immediately ahead will place greater demands on the foundry industry than have ever existed before, said Mr. Maloney, in outlining future foundry problems in production, castings quality, and manpower needs. Solutions to these problems, he explained, outlining them in detail, lies in training, mechanization, and taking full advantage of Society membership and publications.

Second day of the conference was devoted to technical sessions at the University of Washington. With Prof. Gilbert S. Schaller presiding, the conference technical program was opened with an address of welcome by Dr. Bryan T. McMinn of the university.

First technical speaker was Kenneth L. Clark, International Nickel Co., Los Angeles, who outlined uses and properties of nodular iron. By the end of the year some 15 to 20 thousand tons of nodular iron castings will have been produced for the 12-month period, he predicted. Typical properties based on figures reported by a number of producers were cited and pictures of castings currently being made of nodular iron were shown. Chairman of the nodular iron session and the meeting on gating which followed was Prof. Wm. A. Snyder, University of Washington.

During the gating session, the latest A.F.S. research film in color and sound showed recommended practice for gating to eliminate dross inclusion in light alloys. (A resumé of the commentary and scenes from the film appear in a story on page 28.) The film continues where the earlier popular fluid flow film ends and constitutes a progress report on the work directed by the Aluminum and Magnesium Research Committee.

Tells Hydraulics of Gating

Luncheon for conference attendants was held on the campus. Stanley H. Marshall, Atlas Foundry & Machine Co., Tacoma, Wash., presided, and Prof. Schaller introduced the speaker, Engineering Dean H. E. Wessman, University of Washington. Dr. Wessman said that the regional conference paved the way to better understanding between the foundry industry and the engineering college and helped show the place of the engineering graduate in castings production.

Prof. Snyder presided again at the afternoon technical meetings. The first speaker was Michael Bock, II, Exomet, Inc., Conneaut, Ohio, who described the use of exothermic materials to maintain riser fluidity during feeding of castings. Charles Locke, Atlas Foundry & Machine Co., applied theoretical considerations to practical foundry problems in his talk *"An Approach to Gating from the Standpoint of Hydraulics."*

The committee which planned the Northwest Regional consisted of: *chairman*, Charles M. Anderson, Eagle Foundry Co.; J. V. Reardon, Federated Metals Div., American Smelting & Refining Co.; Norman R. Ekholm, Norton Co.; Donald M. Williams, Campbell Hardware & Supply Co.; James D. Tracy, Salmon Bay Foundry Co.; Stanley H. Marshall, Atlas Foundry & Machine Co., Tacoma; R. N. Tompkins; Western Foundry Sand Co.; Fred R. Young, E. A. Wilcox Co.; and Professors Schaller and Snyder. All are from Seattle except as noted. Conference reporter was Fred R. Young, E. R. Wilcox Co.

Northwest Regional Foundry Conference attendants at the conference luncheon, University of Washington.

CONTINUOUS FILING AS APPLIED TO CASTINGS

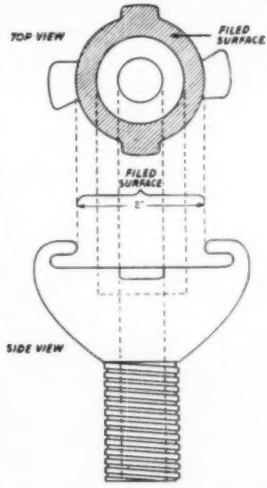
H. J. Chamberland
Research Engineer
The DoALL Company
Des Plaines, Illinois

POSSIBILITIES that the band or continuous filing process might actually perform the functions of a milling machine, broaching machine, or shaper were appreciated only in part during the last war, and many of its potentialities at that time have since been realized. Bandfiling, heretofore accepted only as a "die maker's finishing tool," was one of the many new methods which helped relieve the terrific 1942-43 production problems caused by tool shortages, slow deliveries of equipment, and the lack of skilled labor.

One of the first post-war projects by research engineers was the development of filebands that could really "bite" off metal and maintain precision of cut and accuracy of finish for which the tools were originally intended. It is obvious that this new machining technique is now proving beneficial to users of castings in more or less limited quantities, namely, in lots where far more costly equipment and related operating costs would make the unit cost prohibitive. Within certain limits it is possible to meet the close dimensional tolerances of precision castings with bandfiling of sand castings.

Industry has three distinct filing procedures at its disposal, and each has its particular advantage; in fact, two and even all three methods are often used to expedite certain complicated shapes to the desired finish. However, it is well to bear in mind that both hand and jig files are reciprocating tools, i.e., they actually

Bandfiling surface of 0.40 carbon steel casting with ½-in. flat short angle file at a velocity of 125 fpm, after removing riser by friction sawing. Production averages 25 pieces per hour with the removal of approximately 3/32 in. of material from each piece. Band machine permits quick switch from saw to band file.



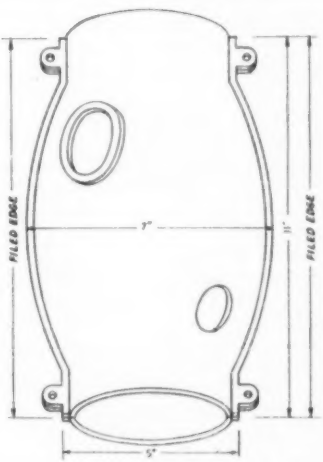
Typical bandfiling applications and average production rate per hour of all three filing methods as estimated from 8-hr tests in relative plants.

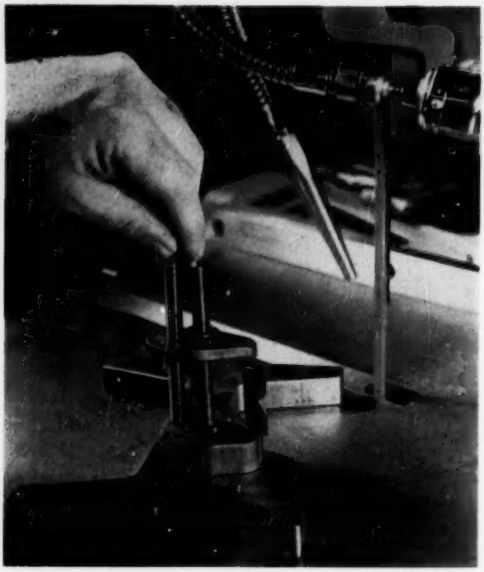
Aluminum Forging

Filing Method	Pieces/hr
Hand	5
Jig	16
Band	41

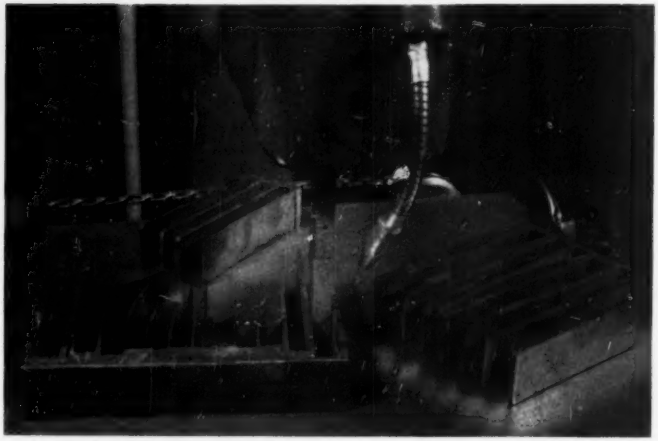
Malleable Iron Casting

Filing Method	Pieces/hr
Hand	5
Jig	16
Band	41





Above—Generally speaking, bandfiling definitely requires no set-up time; however, shop-made fixtures such as shown are often used to facilitate the handling of small parts and improve accuracy of operation.



Right—The stock-hogging efficiency of any coarse cut file band may better be determined by a test such as shown. In this case the material is 1-in. oil-hardening steel—one of the toughest on any cutting tool. However, the 3/4-in. 16-tooth bastard file removed 40 cu. in. of metal (11 lb) in 50 hr of continuous cutting. The cutting actions of the short-angle file on cast iron and particularly on various non-ferrous metals are correspondingly faster.

tion even though two or three dozen units were concerned. Naturally, with an application of this nature a point in volume is reached when other means such as broaching come into the picture; however, it is surprising the number of parts that could be bandfiled before broaching proves more economical due to tooling cost as affecting cost per unit.

Bandfiling requires no special set-ups, no regrinding of tools, and any attentive operator can duplicate the precision of a hand-file artist after a few days of practice. The work may be executed in modern contour sawing machines; however, separate bandfiling units are most economical in that interference with the chief functions of contour machining equipment is avoided.

Bastard-cut and short-angle-cut filebands are most commonly used in general practice. Since the introduction of the short-angle file a few years ago, for a definite purpose to be outlined as we proceed, the bastard-cut file now applies particularly to all types of steel. These filebands are available in various numbers of teeth per inch, thus giving a selection based either on maximum cutting rate or finish, and even on a compromise between both factors. Since it is a matter of less than 5 min to change from a roughing to a finishing fileband, maximum production is obtained by taking advantage of both in either the same or separate filing units.

remove metal only 30 sec of each minute consumed.

While the expert hand filer has control over the return stroke by preventing the file from contacting the material, this is not the case with jig filing, and is the reason for short tool life in this respect. In brief, bandfiles are not intended to replace hand or jig files altogether but rather to reduce file costs as a whole, and substantially increase production.

Proper planning along filing lines, as with any other metal-working method, is sure to step up production and lower manufacturing costs. For example, it would be ridiculous to hand file a 1-in. round hole to a square when it can be done three times faster and far more accurately by jig filing.

In another case, it would not make sense to jig file the part if a bandfiler were available to do the job four to five times faster with negligible tool depreciation, or a combination of both. As a matter of

The short-angle file differs considerably from the bastard file, due to its deeply cut knifelike teeth. These tools, standardized at 10 teeth per inch, were particularly designed for cast iron and non-ferrous metals such as aluminum, magnesium, brass, copper, bronze, zinc and non-metals. The increases in cutting efficiency on castings over previously used coarse bastard files are: 50 per cent on light metals; 50 per cent on copper; 30 per cent on brass; 40 per cent on cast iron: and as much as 75 per cent on some types of bronze.

Filebands are manufactured in half-round, oval and flat shapes; widths are 1/4, 3/8, and 1/2 in. Bandfiling speeds never exceed 125 fpm on the softer materials, with 50 or 60 fpm as a minimum on steels. Feeding pressure depends on whether requirements are finish, production, or a combination of both. As a matter of

fact, and contrary to any other chip production method, bandfiling pressure may be exerted to the point of stalling the band without ill effects on the teeth, but this practice is not recommended.

The teeth of a fileband perform very much like those of a sawband. A small chip curls up before each of the tooth points, is dropped when clear of the work, and the segment containing that particular tooth circles around for the next "bite." With a fileband it is even possible to "saw" through a piece of metal and, by carrying to this extent its similarity to the saw, we make it a broach, milling cutter, shaper or lathe tool.

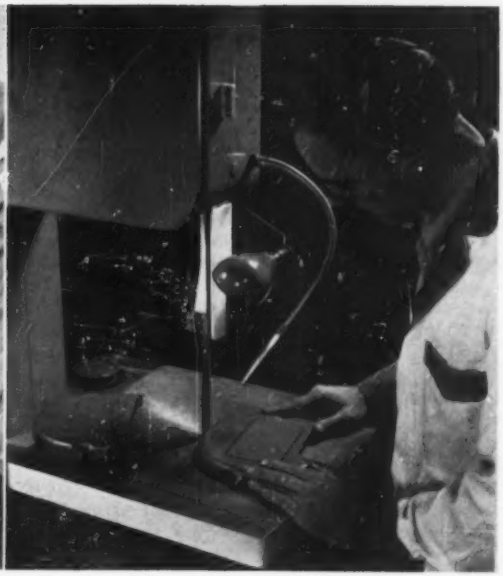
For example, in the laboratory test to determine just how much metal a fileband could remove in 50 hr of continuous cutting with a normal pressure, and meanwhile establish amount of wear, results showed 11.3 lb of chips from a 1 in. thick oil-hardening steel of 74-77 hardness (Rockwell 15-N scale) with less than 15 per cent depreciation in cutting efficiency.

As with bandsawing, pressures used for bandfiling are designated as light, light-medium, medium, medium heavy, and heavy, depending on hardness of material. On this test the steel was extremely hard, so a light-medium pressure was selected. This test could have continued for another 50 hr; however, the amount of material removed would have been considerably less in this second period because the cutting efficiency of the file decreases more and more

Right—Surfacing manganese bronze castings on two sides with ½-in. flat short-angle file at a velocity of 85 fpm. Production rate is 35 pieces per hour, with the removal of 0.030 to 0.040 in. of stock from each side.

Below—Trimming flash from zinc alloy casting with ⅜-in. oval short-angle file at a velocity of 125 fpm. The production rate is 90 pieces/hr.

Below, right—Grinding wheel guard covers are edge-filed at the rate of 60 per hour with a ¼-in. flat short-angle file at a velocity of 100 fpm. The depth of cut averages 1/32 in.



rapidly following the initial 15 per cent loss. Generally speaking, the life of a fileband is set at 125 hr and then, like a hand file, it can still cut but no one is inclined to use it.

It is obvious that clean cutting is essential, since heat has the same effect on the fileband and the surface being filed as with any other chip production process. The wrong file for a particular application is more likely to generate heat that will quickly destroy its effectiveness than the correct file subjected to excessive pressure and operated at an incorrect speed. A heated surface readily becomes a glazed surface which, although quite responsive to a coarse-cut file, has nevertheless become impregnable to the chip-crowded fine-cut finishing file.

Bandfiling is at least four times as fast as reciprocal machine filing and nine times faster than hand filing. On steel, a ½-in. band will cut four times as fast as a ¼-in. band, the softer the material the higher the cutting ratio.

Facts About Filebands and Their Use: Short-angle files seldom clog, but other coarse-cut files do clog, when cutting non-ferrous metals. These filebands should receive the same attention given a hand file, and the teeth kept clean.

A medium-cut file will give a fine finish if the feeding pressure is reduced accordingly.

Tension on the fileband should be released when it is not in use.

A small mirror placed on the machine table at rear of the fileband support enables the operator to watch the progress of the operation.

Single-cut files have an unbroken course of chisel cuts across the surface.

Double-cut files are designed with two courses of chisel cuts crossing each other, the second being finer than the first.

Rasp-cut files have the teeth separated from each other, each tooth being produced by a single punch.

Short-angle-cut files have large milled teeth.

A.F.S. HOME FUND

(Continued from Page 35)

Viking Tool & Steel Co., Buffalo, N. Y.
Vivian Diesels and Munitions, Ltd., Vancouver, B. C., Canada.
Wells Mfg. Co., Skokie, Ill.
Western Materials Co., Chicago.
Wolverine Foundry Supply Co., Detroit.

Pledges of A.F.S. Chapters

British Columbia Chapter.
Canton District Chapter.
Central Illinois Chapter.
Central Indiana Chapter.
Central Ohio Chapter.
Eastern New York Chapter.
Michiana Chapter.
Mo-Kan Chapter.
Northeastern Ohio Chapter.
Northern Illinois-Southern Wisconsin Chapter.
Oregon Chapter.
Philadelphia Chapter.
Rochester Chapter.
Southern California Chapter.
Tennessee Chapter.
Tri-State Chapter.
Wisconsin Chapter.

Gray Iron Founders' Society Holds Two-Day Annual Meet in Cincinnati

CURRENT STATUS of the gray iron foundry industry was the principal topic of discussion at the 22nd Annual Meeting of the Gray Iron Founders' Society, held October 12 and 13 at the Netherland Plaza Hotel, Cincinnati. Some 270 foundry executives participated in the two-day program.

Principal speakers at the two-day conference were William J. Grede of Grede Foundries, Inc., Milwaukee, who addressed the Industry Luncheon on *"Selling the American Tradition,"* and Josh Lee, former United State Senator from Oklahoma, whose talk, *"The Sky Is the Limit,"* highlighted the Society's October 13 luncheon meeting.

Other principal speakers were C. E. Westover of Westover Engineers, Milwaukee; John L. Carter, Gray Iron Founders' Society cost consultant; and Dickey Dyer of Dyer Engineers, Cleveland, all of whom participated in a symposium on foundry cost accounting.

Other featured speakers on the program were Lt. Col. Earl Payne, U. S. Munitions Board, Washington, D. C., *"Industrial Mobilization;"* Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, *"Cupola Practice;"* and James E. Trainer, Firestone Tire & Rubber Co., Akron, Ohio, who spoke on *"Let's Protect Our Workmen."*

Honored for "outstanding contributions to scientific advancement of the industry" was Oliver Smalley, Meehanite Metals Corp., New Rochelle, N.Y., who was awarded the Society's Gold Medal for his work as first technical director of the Society and his subsequent work in improving gray iron foundry practice. Arthur W. Palm, Olney Foundry Division, Link-Belt Co., Philadelphia, and J. D. James, Cooper-Bessemer Corp., Grove City, Pa., were awarded first and second cash prizes, respectively, in the Society's new industry-wide contest for redesign of a part or component as a casting in place of some other type of construction.

Newly-elected officers and directors of the Gray Iron Founders' Society for 1950-51 introduced at the meeting are: *president*, E. L. Roth, Motor Castings Co., West Allis, Wis.; *vice-president*, R. G. Schaefer, Schaefer-Goodnow Foundries, Pittsburgh; *secretary*, J. S. Parrish, Jr., Richmond Foundry & Mfg. Co., Richmond, Va.; and *treasurer*, Henry J. Trenkamp, Ohio Foundry Co., Cleveland.

New directors elected are: W. O. Larson, W. O. Larson Foundry Co., Grafton, Ohio; G. I. Gilson, J. E. Gilson Co., Port Washington, Wis.; and G. E. Mellow, Liberty Foundry Co., St. Louis.

New, Smaller A.F.S. Pins Available

Contrasted here in actual sizes are the old A.F.A. pin and the new, smaller A.F.S. pin, reduced in size by popular demand of members of the Society. The new ⅝ in. diameter pins will be traded for the old A.F.A. pins at no extra cost or are available at $1 each from A.F.S. National Office, 616 S. Michigan, Chicago 5.

CONVENTION HOUSING, APPRENTICE CONTEST TECHNICAL MEETING PLANS TAKING SHAPE

PLANS OF TECHNICAL COMMITTEES which were initiated during last Convention are taking shape as papers for the 1951 A.F.S. Convention to be held in Buffalo, N.Y., April 23-26 are received and reviewed in preparation for the technical program at next year's annual meeting. To be held in Buffalo, April 23-26, the 1951 meeting is a non-exhibit program and will be confined entirely to technical sessions, round table luncheons, and shop course meetings.

Convention housing applications will be mailed shortly after the first of the year to all A.F.S. members. Applications should be filled in and returned to the A.F.S. Housing Bureau, to be set up in Buffalo, prior to February 15. All applications received up to that date will be considered as of February 15.

Name 1951 Hoyt Lecturer

The 1951 program will again include such regular Convention features as the Charles Edgar Hoyt Annual Lecture, the Annual Banquet, the Annual Business Meeting, and exchange papers from several overseas foundry societies. The 1951 Hoyt Lecturer will be James C. Zeder, director of engineering and research for Chrysler Corp., Detroit. One of the technical highlights of A.F.S. Annual Conventions, the Lecture is presented each year by an outstanding figure in the foundry or engineering field. Mr. Zeder has been with Chrysler Corp. since its organization in 1925 and has been associated with the large casting consuming automotive industry since graduating from the University of Michigan in 1922.

At the Annual Banquet, gold medal awards and honorary life memberships in the Society will be presented to outstanding men in the foundry field to be selected by the A.F.S. Board of Awards.

Schedule Convention Gating Symposium

One of the outstanding technical sessions on schedule for the 1951 A.F.S. Convention is a Symposium on Principles of Gating. A joint presentation of the Aluminum and Magnesium, Brass and Bronze, Gray Iron, Malleable, and Steel Divisions, the symposium will concentrate on systems with runners and gates at the mold parting. Scheduled for Tuesday, April 24, 1951, the all-day meeting will consist of a series of five 15-minute presentations separated by 15-minute discussions in the morning. The afternoon will be devoted to discussion of experiences in application of good gating principles.

The Timestudy and Methods Committee will have two meetings, one on Part II of its Fatigue Study Survey, the other on job costing using standard data. The Educational Division will sponsor its customary Educational Dinner with speakers on *"Absorbing the Technical Trainee"* and *"Developing the Student for Industry,"* and a technical session devoted to high school, trade, and apprentice schools.

Annual Business Meeting events include election of officers and five directors, the address of National President Walton L. Woody, and his presentation of cash awards and certificates to the first prize winner in each of the five divisions of the A.F.S. Apprentice Contest.

Now in its 28th year, the contest is open to all apprentices in the United States, Canada, and Mexico who are taking a regular course of training of not less than three years' duration. Contestants may not be over 24 years old on the day they prepare their entries; veterans' age limit is 24 plus length of service in the Armed Forces.

Prizes awarded in each of the five divisions—Gray Iron, Non-Ferrous, and Steel Molding, and Metal and Wood Patternmaking—include certificates and the following amounts in cash: first prize, $100; second prize, $50; and third prize, $25. In addition, the first prize winner in each division is provided with round trip rail and Pullman fare to attend the Convention.

The 1951 A.F.S. Apprentice Contest opened September 15 and will conclude March 1 with national judging planned for March 24 in Buffalo. This year for the first time judges will observe a new regulation which states that in each division "entries must be salable castings and patterns, and to qualify for prizes, the first prize winner must rate a score of 88 points minimum, the second prize winner 85 points minimum, and the third prize winner 76 points minimum, in the national judging of contest entries."

Apprentice Contest Still Open

Complete information on the contest can be obtained by writing to Jos. E. Foster, Technical Assistant, American Foundrymen's Society, 616 S. Michigan, Chicago 5, Ill. In addition to regulations, A.F.S. Headquarters supplies patterns for the molding divisions, blueprints for wood patternmaking, and rough aluminum castings and blueprints for metal patternmaking.

Apprentices may enter the A.F.S. Apprentice Contest as individuals or through a plant or chapter contest. In addition to a number of individual entries, the national judging will include winners of contests held by the St. Louis District and the Wisconsin chapters, and by Caterpillar Tractor Co., Peoria, Ill., and Textile Machine Works, Reading, Pa. The three Canadian chapters, which frequently sponsor national winners in the contest, are expected to enter a number of contestants, as are other chapters active in the competition in past years.

For use in the Metal Patternmaking Division of the 1951 A.F.S. Apprentice Contest, Vaughan C. Reid, City Pattern Foundry & Machine Co., Detroit, provided 50 rough aluminum castings. Eighteen aluminum patterns for the molding divisions of the contest were supplied by George E. Garvey, City Pattern & Foundry Co., South Bend, Ind. The 18 patterns were finished by F. W. Burgdorfer, Missouri Pattern Works, Inc., St. Louis, who also submitted the drawings for the two patternmaking divisions, the pattern for the 50 rough aluminum castings, and the wood pattern from which the 18 duplicate molding divisions patterns were made. Shipping boxes for the molding divisions patterns were made at Caterpillar Tractor Co.

MODERN FOUNDRY METHODS . . .

CYLINDER BLOCK CLEANING

Monorail cooling conveyor synchronized with molding reel removes casting from drag mold, carries it through 3-hr cooling cycle, then delivers it to knockout area at reduced temperature to facilitate handling.

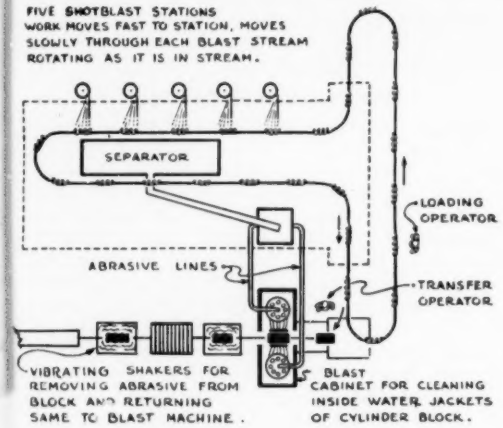
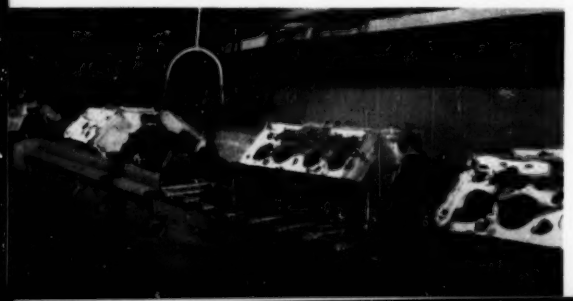


Diagram A shows passage of castings through two shotblast cabinets. Special arms on monorail conveyor rotate castings as they pass in front of five shotblast wheels, permitting good coverage of external surfaces.

Monorail cooling conveyors carry some 440 castings per hour, drop them onto H-chain conveyor for transportation to knockout areas for removal of flash, sand.



Latest known techniques and equipment for removal of core sands and foreign materials from castings are being employed at Ford Motor Co.'s Dearborn Iron Foundry, Dearborn, Mich., for the external and internal cleaning of automotive cylinder blocks. Through use of this new process and equipment, Ford has practically ruled out the possibility of engine trouble developing because of inadequate block cleaning.

Largest production foundry in the world in physical

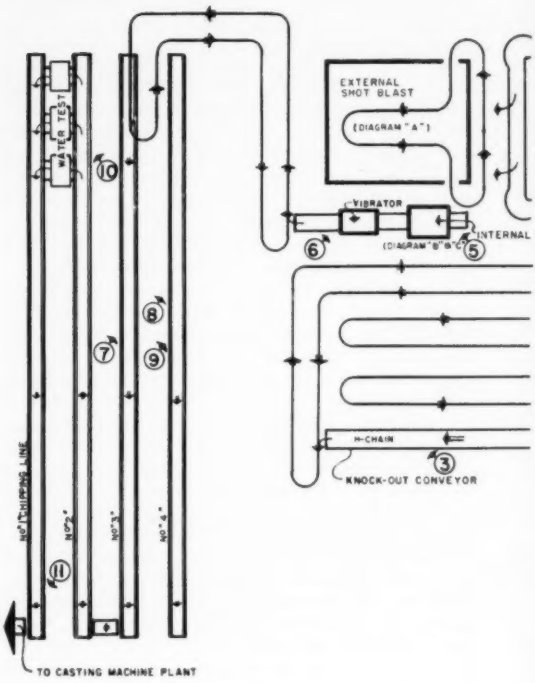


Diagram of Cylinder block cleaning process layout at

size and metal capacity, Ford's Dearborn Iron Foundry utilizes highly-mechanized equipment to accomplish molding, coremaking, melting, and cleaning of castings. Mechanization of castings cleaning operations has been a deciding factor in enabling the Ford foundry to produce some 7,000 units daily, comprising three different types of engine blocks.

Purpose of this article is to illustrate cleaning operations performed and methods and equipment used. To this end, a complete cleaning cycle for the Ford eight-cylinder, V-type engine block is shown in the accompanying photographs and diagrams.

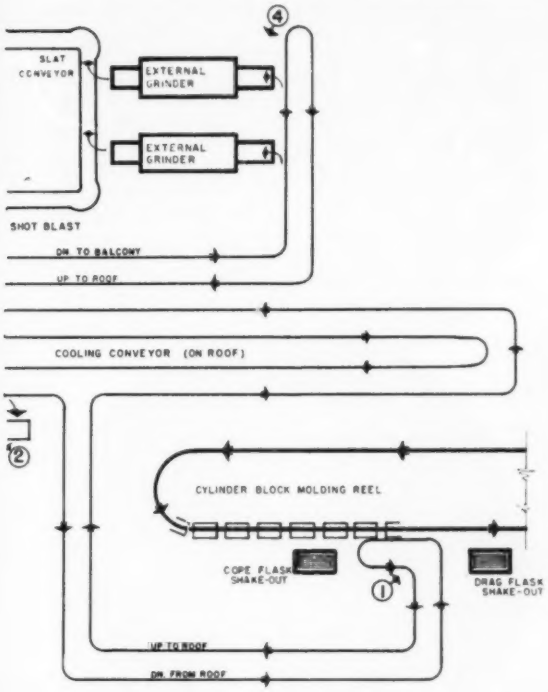
The large central diagram on these pages shows the

. . . MODERN FOUNDRY METHODS

AT FORD MOTOR CO.

process layout of the entire operation and is marked with numbers corresponding to those of photographs to indicate the relative position in the layout of each separate operation. Smaller diagrams show internal arrangement of various shotblast machines used and indicate the flow of abrasive material and positioning of the castings.

Included in the over-all operation are such major pieces of equipment as: four cooling conveyors, two knockout areas, three external shotblasts, one internal



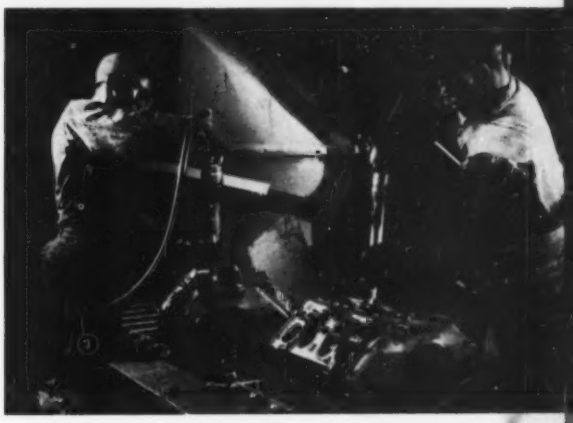
Ford. Circled numbers correspond to those on photos.

shotblast, four chipping and grinding lines, and nine water test machines; all so arranged as to provide flexibility to meet changes in production.

Sequence of operations is as follows:

Cooling conveyor, synchronized with molding reel, removes casting from drag mold (Fig. 1), then carries it through a 3-hr cooling cycle to permit handling in knockout area. Casting is then removed from cooling conveyor and placed on H-chain knockout conveyor (Fig. 2). Each of four cooling conveyors carries approximately 110 castings an hour to knockout areas, where most excess flash and sand is removed.

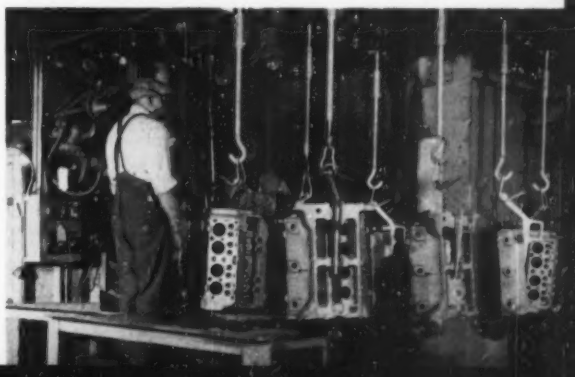
Figure 3 shows typical operation in knockout area—



Operators use pneumatic hammers equipped with special punch designed to remove flash from intake valve port holes in cylinder block. Castings are then carried by transfer conveyor to automatic grinder section.

Castings are loaded into automatic grinder and so positioned that wheels grind top and bottom faces simultaneously, and are then conveyed to shotblast area.

Cylinder block castings shown emerging from external shot blast cabinet (at right) and moving toward internal blast cabinet at left. Here blocks are removed from conveyor and loaded into internal cabinet.



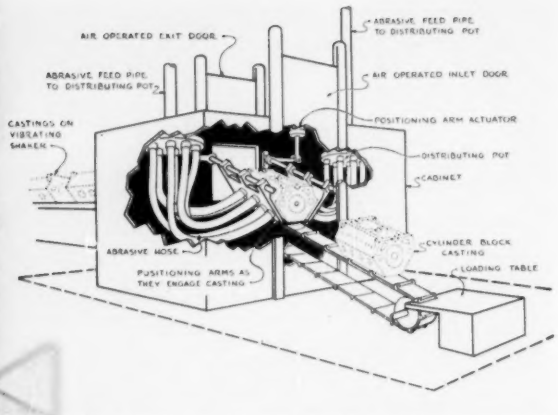


Diagram B. Internal shotblast cabinet with (right foreground) loading table from which casting is placed on indexing conveyor which positions it in cabinet.

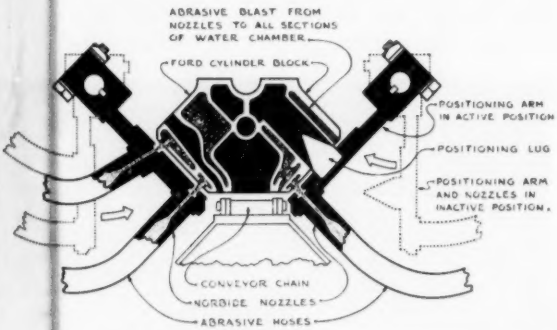
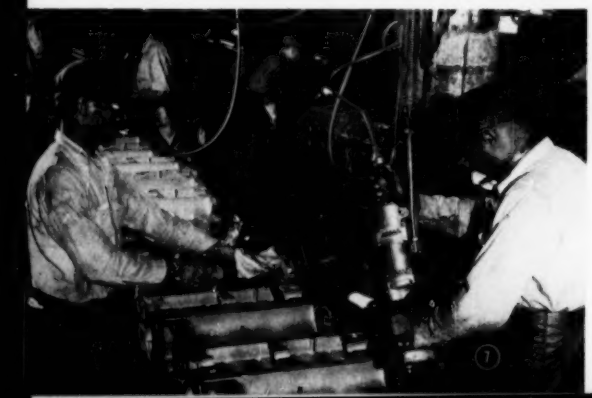

ABRASIVE BLAST FROM NOZZLES TO ALL SECTIONS OF WATER CHAMBER
FORD CYLINDER BLOCK
POSITIONING ARM IN ACTIVE POSITION
POSITIONING LUG
POSITIONING ARM AND NOZZLES IN INACTIVE POSITION
CONVEYOR CHAIN
NORBIDE NOZZLES
ABRASIVE HOSES

Diagram C shows final location of cylinder block in internal shotblast cabinet. Positioning arm and blast nozzles operate simultaneously from a common shaft.



Pan-type conveyors serve chipping lines, where hand grinding, chipping and punching operations are performed. Operator at right is grinding rear motor mount, while other punches drain hole in crankcase.

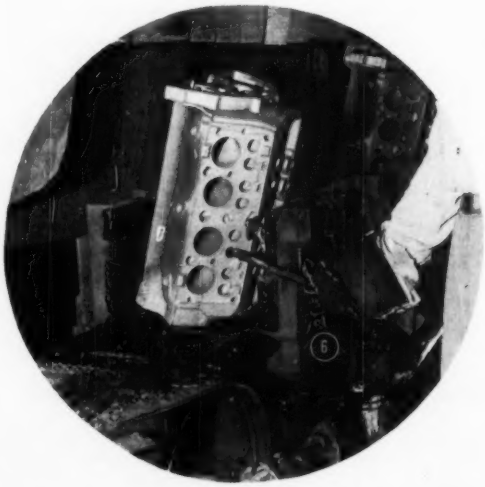
punching of intake valve port holes with a pneumatic hammer equipped with a punch that assures complete removal of flash from holes. Castings are carried by the knockout conveyor through a series of operations similar to the one illustrated, then are delivered to automatic grinders by transfer conveyor.

Figure 4 shows grinder loading process. After positioning, castings travel between grinding wheels which grind top and bottom faces of block. Another operation finishes ends of castings, which are then fed by buggy-type transfer conveyor to three external shotblast machines. Castings are shotblasted at the rate of four per minute. Diagram A shows passage of castings through shotblast cabinet, where they rotate in front of five blast wheels (Fig. 5).

Castings are then transferred to internal shotblast. Diagram B shows how indexing shotblast conveyor locates the casting. Final locating and blasting is illustrated by Diagram C. Positioning arm and blast nozzles operate from a common shaft simultaneously. Following this blasting, castings move down vibrating shaker which removes trapped abrasive (Fig. 6).

Conveyor for chipping lines passes directly over belt and transports castings through these lines, where they are finished, tested and inspected. Figure 7 illustrates hand grinding and punching operations.

Most castings inspections are visual but some, such as the dry magnetic inspection processes shown in Fig. 8



Following blasting of internal surfaces, castings move onto vibrating shaker for removal of trapped abrasive, then are placed on belt which carries them to a conveyor for transportation to the chipping lines.

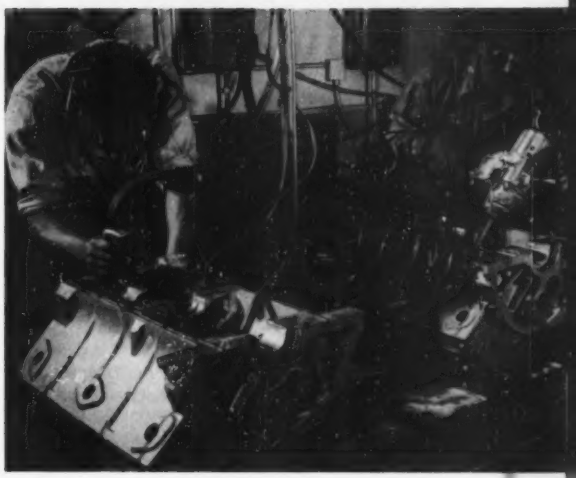
and 9, are mechanical or electrical and detect defects not visible to the naked eye.

Located adjacent to the chipping line is water testing equipment (Figure 10). Casting is clamped vertically into the machine and water at 80 psi pressure is forced into the casting and held for a predetermined length of time while casting is inspected for leaks. If a leak is discovered it is circled and casting is inspected for possible salvage.

Castings are now ready for finishing operations and

final inspection. This is done on the No. 1 chipping line, located next to the machine shop. In Fig. 11 castings are being removed from chipping line and transferred to the machine shop through a broach which machines locating spots on casting. Final inspection and count of castings is then made.

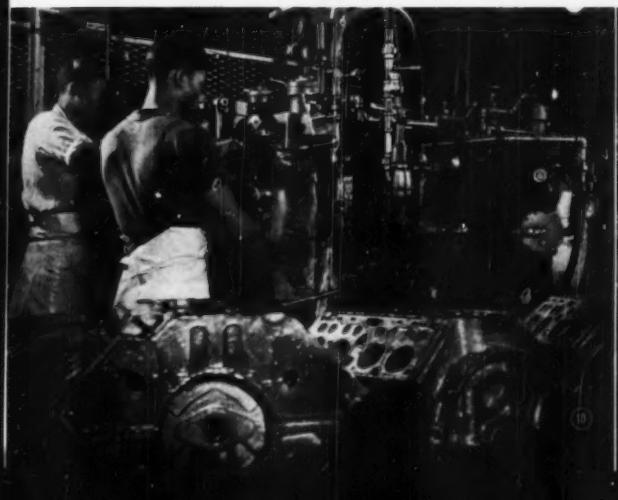
Since it is not possible to describe every cleaning operation in this article, only typical operations have been illustrated. Cleaning of a casting is in the final analysis influenced by the way it is made.

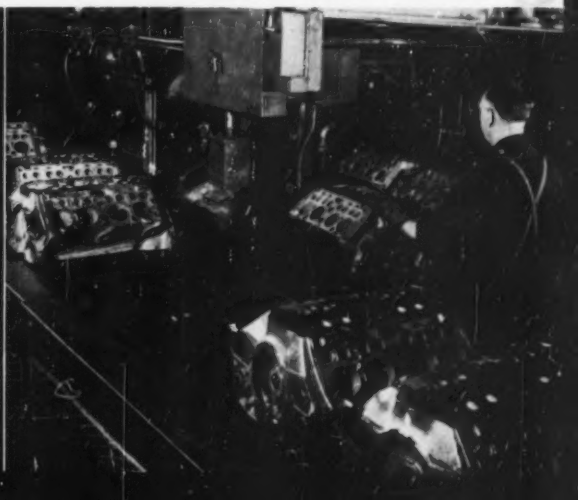


Detecting invisible casting defects by dry magnetic inspection. Operator at right is reaming oil drain holes, while operator at left is placing electrodes. Most defect inspections, however are visual.

Close-up view of dry magnetic inspection for cylinder block casting defects invisible to the naked eye.

(Below, left) Following chipping and cleaning, casting is clamped vertically into water test machine. Water at 80 psi pressure is forced into casting while operators inspect casting for leaks. If leak is discovered, it is circled and casting is inspected for possible repair and salvage. (Below, right) Following water test, cylinder block castings are sent through a broaching machine, which machines locating spots on casting. At this point, the casting receives its final inspection and is counted. Broaching is the final operation performed in the foundry. Casting is then transferred to machine shop for finishing.





PURDUE CONFERENCE COMBINES TECHNOLOGY, CASTINGS EXHIBIT

CASTING DESIGN, sand, gating and risering, foundry education, and new engineering developments were crowded into the less than two-day Metals Casting Conference held at Purdue University, November 2 and 3. Sponsored by the Michiana and Central Indiana chapters of A.F.S. and Purdue University, this third annual conference included an exhibit of castings produced by foundries of the area interested in the Foundry Educational Foundation.

Chairman of this year's conference was L. L. Andrus, American Wheelabrator and Equipment Corp., Mishawaka, Ind.; vice-chairman was Prof. C. T. Marek, Purdue, and program chairman was Robert Spurgin, III, Swayne, Robinson & Co., Richmond, Ind.

Conference Chairman Andrus opened the regional meeting by introducing Henry Abbet, Purdue purchasing agent, who stressed the importance of continuing the educational process in adult life and sharing industrial experiences, in welcoming the foundrymen to the university. In his talk *"Industry Looks to the University,"* the second speaker, A.F.S. Past Director Stowell C. Wasson, National Malleable & Steel Castings Co., Chicago, stated that changes taking place in industry put greater responsibility on the foreman.

A.F.S. National President Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, spoke briefly on the work of the society, pointing out that it is the only overall technical society in the foundry industry. Membership, he said, is open to everyone interested in foundry work. A.F.S. provides a forum for discussion and dissemination of information on foundry problems, he declared.

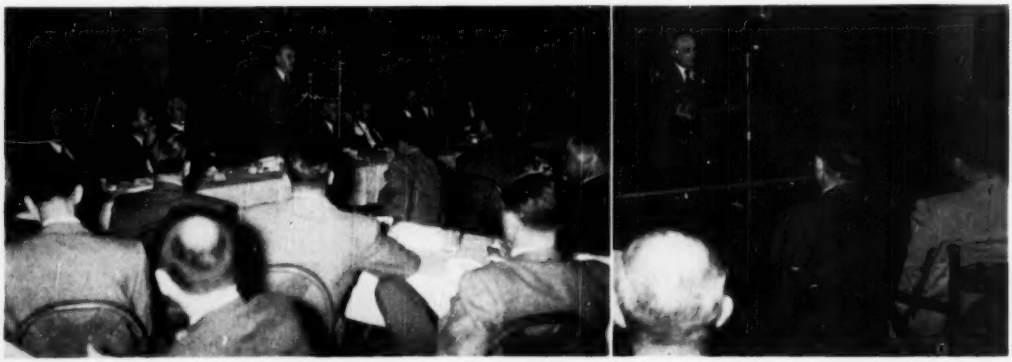
Prof. H. A. Bolz of Purdue was chairman of the following session with Fred Carl and J. J. McClain, Bedford, Ind., presenting technical papers. Subject of the two related papers was *"Recent Engineering Developments in the Foundry Industry."* Speaking first, Mr. McClain described the production in plaster molds of the five precision aluminum alloy castings used in the Buick automatic transmission. Castings produced by the process—to be described in an early issue of AMERICAN FOUNDRYMAN—must have less than 0.025 in. cope and drag shift, be within plus or minus 0.010 in. on vane location, and plus or minus 0.005 in. in thickness. There is a trend in plaster mold casting toward the use of dielectric baking to reduce production time and to reduce floor area required for equipment. Synthetic resins can be used to produce patterns and core boxes cheaper and to closer dimensional tolerances than by hand scraping metal, Mr. McClain said.

Mr. Carl summarized current information on the use of oxygen in the cupola and described the shell molding process. In comparing results reported for 19, 48, and 72-in. diameter cupolas, he showed that beyond about eight per cent oxygen the cost is prohibitive even though melting rate increases, tapping temperatures are increased, and melting is cleaner.

Describes Shell Molding Process

Essential features of the shell molding or C process, described by the speaker, are a metal pattern plate which fits a box mounted on trunnions, a sand mixture containing six to eight parts by weight of a thermosetting resin, and a paraffin-base or similar parting compound. With the pattern at about 350 F a quarter-inch shell of the sand mixture forms in 15 to 20 seconds. Subsequent baking at about 570 F for three to five minutes produces a half mold with the appearance of a molded plastic product.

The half shell-molds can be assembled by pasting or clamping, said Mr. Carl, and are usually placed in a box and backed up with steel shot or other suitable material. Pouring is done in the usual manner and cleaning is done in the customary way but is greatly



Left—William Ferrell, Auto Specialties Mfg. Co., St. Joseph, Mich., acts as toastmaster for Metals Casting Conference banquet. Right—Purdue Engineering Dean A. A. Potter makes unscheduled short talk at technical session. Photos courtesy Lewis Reiff, Superior Steel & Malleable Castings Co., Benton Harbor, Michigan.

reduced. Overall tolerance on castings reported by the speaker was plus or minus 0.003 in.

The afternoon of the first day was devoted to casting design and use of engineering graduates in the foundry. Speaker on design was William T. Bean, Jr., Industrial Electronics, Inc., Detroit, who described evaluation of material, design, and load, and told how to use testing instruments to produce superior designs. Selling castings by the piece rather than by the pound encourages good casting design, he declared. He showed how to eliminate ribs and streamline castings to give them superior properties and make them easier to produce in the foundry.

Next speaker was A.F.S. Past President E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md., whose topic was "*Engineering Graduates in the Small and Medium Foundry.*" Co-chairmen of the meeting were George K. Dreher, Foundry Educational Foundation, Cleveland, and Paul W. Harlan, Electric Steel Castings Co., Indianapolis. Technically trained men are no longer a luxury, but are a necessity to the foundry, Mr. Horlebein stated. Time must be taken to train college men so the foundryman can take full advantage of their technical education although more and more engineering graduates are gaining actual foundry experience through summer work, he declared. Mr. Harlan commented on the growth of the FEF program at Purdue and told how foundrymen had set up an advisory committee to assist in expansion of foundry facilities.

Discussing casting design are, left to right, Prof. G. W. Bergren; Speaker William T. Bean, Jr., Industrial Electronics, Inc., Detroit; and Robert Spurgin, III, Swayne Robinson & Co., Richmond, Ind. Photos on this page provided courtesy Purdue News Service.

At the banquet concluding the first day's activities, the 25 boys in the FEF program at Purdue were guests of individual foundrymen who assisted them in getting acquainted with foundry industry leaders present. Speaker was L. P. Robinson, Archer-Daniels-Midland Co. (Werner G. Smith Div.), Cleveland.

Preceding the start of technical meetings the second day, Conference Chairman Andrus called on A. A. Potter, engineering dean at Purdue, whose persuasiveness and enthusiasm, he said, were largely responsible for the acceptance of the FEF program at Purdue. Dean

Conference participants included, seated, left to right, A.F.S. Past President E. W. Horlebein, Gibson & Kirk Co., Baltimore; A.F.S. President Walton L. Woody, National Malleable & Steel Castings Co., Cleveland; Paul W. Harlan, Electric Steel Castings Co., Indianapolis. Standing are, at the left, FEF President Claude B. Schneible, Claude B. Schneible Co., Detroit, and FEF Executive Director George K. Dreher, Cleveland.

Potter assured his listeners that the Purdue staff would do its utmost to teach foundry practice as the foundry industry wants it.

At a session with Allen J. Reid, General Refractories Co., Indianapolis, Ind., as chairman, A. F. S. Technical Director S. C. Massari showed the new color-sound research film on gating entitled "*Fluid Flow in Transparent Molds.*" (A condensation of the story told by the film appears on pages 28-31).

Following the film and discussion, led by Mr. Massari, Norman A. Birch, National Bearing Metals Div., American Brake Shoe Co., Meadville, Pa., spoke on control of gating and risering.

A mere record of varying methods of gating and risering is not sufficient to establish basic principles, Mr. Birch said, pointing out that this required studies like the A.F.S.-sponsored research on gating directed by the Aluminum and Magnesium Division's Research Committee and the investigation on risering directed by the Research Committee of the Gray Iron Division. He described a rigging card file system (AMERICAN FOUNDRYMAN, September, 1950, page 56) used in National Bearing's Meadville plant and told how it can be used to reduce casting losses.

Concluding session of the conference was held early the afternoon of the second day. R. P. Schauss, Illinois Clay Products Co., Chicago, outlined foundry sand fundamentals. Co-chairmen were Prof. C. T. Marek and Robert Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich.

The Conference Committee, in addition to Messrs. Andrus, Marek, and Spurgin, included: Prof. R. W. Lindley, secretary; Messrs. Swain, Ferrell, Harlan, Reid, and Reiff; M. M. McClure and Prof. Bolz of Purdue; and V. S. Spears, American Wheelabrator & Equipment Corp., Mishawaka, Ind.

gray iron WELDING JOINING CUTTING

C. O. Burgess
Technical Director
Gray Iron Founders' Society, Inc.
Cleveland

PART III

1. Thermit Welding: The thermit welding process, i.e., molten metal produced by the heat generated from reaction of aluminum with iron oxide, may be successfully used for the joining or repairing of gray iron, if the limitations of the process are understood. For example, such joining or repairing is commonly limited to comparatively thick castings, preferably of a square or round cross-section. It should also be realized that the shrinkage of the weld metal produced by the thermit process, since it is essentially a high-silicon steel, is about twice that of the parent gray iron.

The process is, consequently, not suitable for repairing long cracks (with lengths exceeding approximately eight times the casting thickness) in thin sections, or cracks extending only partially through the casting section unless they are preliminarily cut

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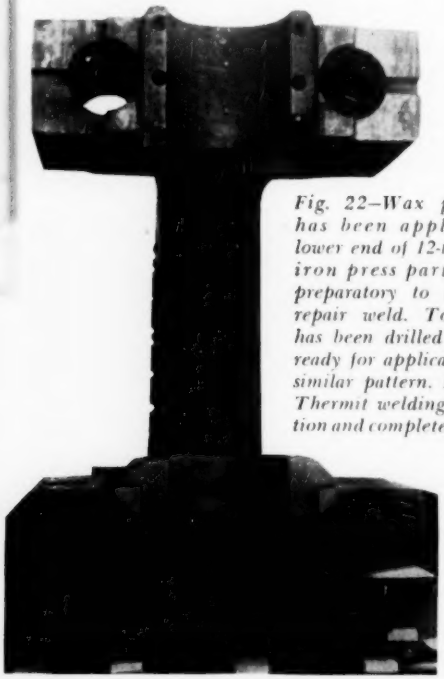
This is the final section of the material on elevated temperature methods of welding, joining, and cutting gray iron, which will constitute Chapter VII of the *Gray Iron Handbook*, to be issued by the Gray Iron Founders' Society, Inc. Sections I, II, appeared in Oct. and Nov., 1950, issues of AMERICAN FOUNDRYMAN.

all the way through. The finished weld is somewhat harder and tougher than ordinary gray iron, but may still be machined.

The process is essentially the same as that used for the thermit welding of steel.[1] The ends to be joined should be cut so as to form a parallel-sided gap. The gap is filled with wax to make a pattern around which a sand mold is formed. The wax is then melted out, and the ends to be joined are heated to a red heat with a kerosene-air burner inserted through an opening left in the mold. The opening is then plugged and the thermit mix, contained in an inverted re-



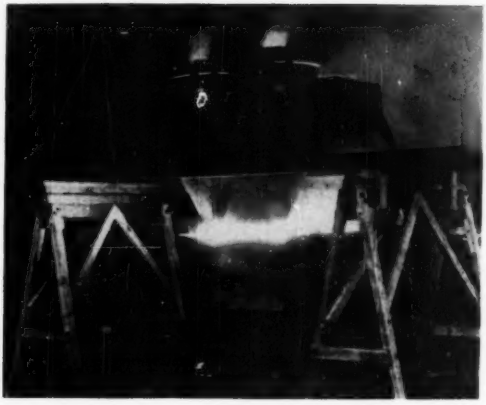


Fig. 22—Wax pattern has been applied to lower end of 12-ton cast iron press part (left) preparatory to thermit repair weld. Top end has been drilled and is ready for application of similar pattern. Right—Thermit welding operation and completed weld.

fractory lined cone connected by a gate with the cavity, is ignited.

The reaction of the cast iron thermit, consisting of aluminum and iron oxide to which 3 per cent ferrosilicon and 20 per cent mild steel punchings have been added,[2] takes about 30 sec. The molten metal resulting from the reaction of aluminum and iron oxide is then tapped into and allowed to fill the cavity. After cooling, the mold is removed, revealing the completed joint. Because of the slow cooling insured by the surrounding sand mold, the weld is, in general, machinable, and it is usually unnecessary to stress-relieve unless the casting is part of a rigid structure.[8, 19, 31]

2. Soldering: Soft solders have been defined as "metals or alloys. . .which melt at temperatures below the melting point of the base metal and in all cases below 800 F."[19] This low melting point automatically limits solders to alloys high in lead, tin, zinc or combinations of these elements. For example, a typical solder for use with gray iron consists of 35 per cent tin, 30 per cent lead and 35 per cent zinc.[15]

Soldering is used to a limited extent on gray iron for repair of small surface defects, for water- and pressure-tight repair of cracks, for build-up and, to a small extent, for joining gray iron to other materials where strength is not a prime requirement. The soldering material normally employed has a pressure strength of approximately 1000 psi. One advantage of the process is that it will not in any way damage the parent metal, and it is thus used for repair of minor defects in expensive castings, especially if such defects are discovered after considerable machining has been done. It is also used on bearing faces.

Soldering Gray Iron

Three typical methods used for gray iron soldering are as follows:

(1) A soldering iron heated to a dull red is often used for repair of small blowholes, and other minor defects. The metal surface must be cleaned and various chloride-base fluxes have been employed. In one typical application the surface is cleaned with hydrochloric acid. The usual solder will not run, and may be built up as high as necessary.[32] Some operators, particularly if any tinning difficulties are exhibited, prefer to tin the bonding area with a relatively high-tin solder (50 per cent or more tin) before continuing soldering with a usual solder.

(2) Torch soldering with an oxy-acetylene flame is also widely employed. The surface may be cleaned with hydrochloric acid and then seared with an oxidizing flame to remove the graphite. The flame is then adjusted so that there is a slight excess of acetylene, and the solder is introduced in the form of a filler rod.[15,33] Soldering temperatures of the order of 450 to 500 F are employed.

(3) If small castings are being joined as parts of soldered assemblies, the hot-dip process employing a bath of molten solder may be used. In this process, it is necessary first to insure a clean surface by grinding, turning, or shotblasting, followed by degreasing and, still better, by degraphitization of the surface. The assembly is then dipped in the molten solder bath through a layer of fused flux consisting of 75 per cent zinc chloride, 15 per cent sodium chloride, and 10 per cent ammonium chloride.[34]

Special soldering processes have recently been developed that have shown promise when used with gray iron. In one of these a paste-type solder,[43,44] in which the solder is suspended in a fluxing medium, is applied at temperatures of 550 to 600 F. A gas torch is normally used, and vigorous scrubbing of the heated surfaces during application of the solder is reported to dislodge surface graphite and assure a well-tinned surface.

3. Flash Welding: Flash welding is a very rapid method of welding together parts of comparable cross section. In simplest terms, flash welding consists of bringing the parts to be welded in contact and passing a heavy current through this joint sufficient to produce local arcing and fusion over the entire area of the abutting metal faces. After this resistance heating is substantially completed, the parts are pressed together, usually by the use of a hydraulic ram, thereby producing a resistance weld that closely approaches the parent metal in strength. A flash weld can be completed in a matter of seconds.

Fig. 23—Fracture of flash-welded gray iron pipe shows complete fusion and the gray structure of the weld.

The process has been found to be entirely feasible as concerns welding gray iron, and by properly positioning the electrodes attached to the parts to be welded and adjusting the space between them, the formation of white iron at the joint can be prevented.[45] A flash or extrusion of metal occurs at the flash-welded joint, which may be machined or ground off if necessary. In the case of pipe, which is the material most frequently submitted to this process, it has been found possible to limit the amount of this extruded or upset metal on the interior of the pipe by use of a copper mandrel.

Flash welding machines with the necessary equipment for very heavy electric currents and high pressure are comparatively expensive; despite speed and ease of welding, an installation would normally be justified only on the basis of a large volume of steady and repetitive work. However, at least one concern regularly engaged in flash welding a wide variety of metals reports that they are set up to flash weld gray iron for any interested customer, and that some of their flash welded assemblies, such as carbonizing towers, are now in commercial use.

Despite its limitations the flash welding process, because of its speed and dependability, deserves consideration when a large number of similar gray iron

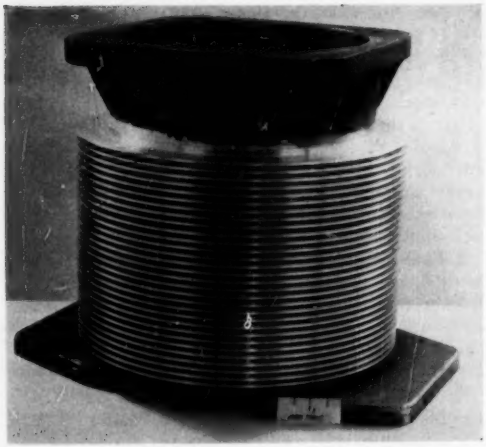


Fig. 24—Aluminum cooling fins are bonded to a gray iron base in this example of a bimetallic casting.

units must be welded together. The possibilities of the process as applied to castings have evidently not been fully recognized.

4. Pressure Welding: Pressure welding of gray iron has reportedly been successfully carried out on an experimental scale[40] although apparently no commercial applications of the process have so far been developed. The process is of interest since no actual fusion of the gray iron parts is necessary.

Prepare Matching Surfaces

The pressure welding process as applied to gray iron, although it undoubtedly must be modified, is apparently similar to the familiar one used for steel. The two surfaces to be joined are first prepared so as to have closely matching surfaces. The surfaces are brought together under pressures and heat applied to the joint by an oxy-acetylene torch. Presumably an induction coil could also be used as a heating medium. Heating is continued until a predetermined amount of upsetting under the applied pressure occurs at the heated joint.

Operating temperatures and degree of upset must obviously vary from those employed for steel in view of the lower melting point and limited hot working properties of gray iron, but joint efficiencies of 60 to 99 per cent of the strength of the base metal have been reported in simple round sections. The joint efficiencies are in the high range when high strength irons are employed. In this regard it appears that very high carbon content and/or a high phosphorus content in the iron to be joined will limit joint efficiency and the amount of upset that can be used before vertical heat cracks appear in the upset metal.

As previously noted, although pressure welding of gray iron has not been applied on any wide commercial scale and will obviously be limited to certain types of castings, it possesses at least potential promise as a joining method in the casting field. Since no fusion takes place, the welds can be kept gray and machinable. Gray iron can obviously be readily joined to steel using this process without affecting the machinability of the joint.

This process, together with other welding processes which possess this characteristic, suggest such future possibilities as gray iron inserts to minimize vibration, gray iron-steel bearings, gray iron exhaust parts attached to steel sections of turbines, bimetal internal combustion engines, etc.

5. Bimetal Castings: Cases frequently arise where a combination of properties are required in a casting that cannot be met with any single metal or alloy. In this regard, it is of interest that gray iron has been successfully employed to produce bimetal castings, that is, integral castings composed of one or more metals and gray iron. Such castings can be made by casting the metals consecutively in the same mold, or one metal may be cast against the precast, formed, or machined surface of another metal.

This process is a welding method in so far as it involves formation of a bond or weld between the two metals sufficiently strong to result in a single integral assembly. This type of bonding is of particular significance in the case of gray iron because of gray iron's unusually good casting quality, the fact that it can be rendered fluid at comparatively low temperatures, and its ability to form a good bond of this character.

Bimetal castings are produced by either static or centrifugal methods of casting. Static methods are the oldest, and it has long been the practice in producing wear-resistant rolls to cast a hard chilled-iron composition into the mold, allow a hard crust to form, and then to rapidly pour out the unsolidified core metal and refill the core and neck cavities with a soft, machinable iron, or alternatively to actually flush out the harder iron in the core area with a gray iron. In some cases it is possible to pour in tandem, i.e., fill the lower sections of a casting such as an inverted lathe bed[36] with a wear-resistant iron and the upper sections with another softer type of iron.

Producing Composite Castings

This method is also adapted to production of steel-cast iron composite castings; for example, grate bars have been produced by pouring steel into the lower parts of a grate mold which included crank and rib sections, and after a short interval filling the upper wearing face mold cavity with an alloy cast iron resistant to warpage and deterioration.[36] Perfect fusion at the steel-gray iron interface was obtained.

A special case of static casting in which bimetallic castings of gray iron and aluminum are produced by a proprietary process[41] has proved useful. In this process a gray iron part is first immersed in a bath of molten aluminum. When the casting has reached the temperature of the bath a reaction takes place at the surface of the casting with the formation of an intermetallic compound of iron and aluminum. The gray iron is now said to be "tinned." The casting is then placed in the mold and molten aluminum is poured around it, fusing with the "tinned" coating to make a molecular bond between the aluminum and the gray iron.[40, 41]

Potential applications of this process are numerous since the final casting can combine the wear resistance,

heat resistance, rigidity and strength of gray iron with the high thermal conductivity and light weight of aluminum. Gray iron brake drums with aluminum cooling fins have proved to be useful in several applications.[48] Aluminum fins are also reported to add to the life and efficiency of glass molds, air compressor cylinders, convector radiators, and many other gray iron parts operating under conditions where rapid heat dissipation is necessary.

Centrifugal methods of producing gray iron bimetal castings are of later development, but possess some definite advantages. Very accurate control of the thickness of each layer of an integrally cast tube, for example, can be assured by pouring a specified volume of each material into the revolving mold. The outer metal is poured first into the revolving mold, and shortly after this has solidified the inner metal is poured. Composite tubes of gray iron combined with white iron, steel, and nonferrous metals are being successfully produced by this method.

Combine Properties

The proven wear resistance of cast iron has been combined with the toughness of steel by providing a centrifugally cast steel jacket with an inner lining of cast iron. Instead of conventional steel a stainless steel jacket can be employed to confer additional corrosion resistance.

Chilled iron or nickel alloy gray iron grinding rolls can be successfully combined with a thick core of gray iron, thus providing a predetermined and controllable thickness of wear resistant outer material with a readily machinable interior to facilitate the insertion of driving shafts.

The reverse of this procedure, in which the abrasion resistant material such as nickel alloy gray iron is spun within a steel cylinder, is being tested for such end uses as slush-pump liners, mixers, etc.

Relatively high priced alloys, such as certain of the stainless steels and such non-ferrous alloys as the stellites, hastelloys, etc., have been combined with relatively low cost materials such as cast irons, thereby limiting the consumption of the expensive alloys to the surfaces where their use is mandatory. Massive textile rolls, where most of the weight is provided by a cast iron core and the outer surface only consists of a stainless steel, offer a good illustration of this type of combination.[49]

It is, of course, possible to use a fabricated core or outer shell, one of the most successful processes of this type in use today being the production of bi-metallic brake drums for heavy duty applications. Gray iron is generally recognized to be the best material for brake drum wearing surfaces;[38] however, in some cases where high stresses are involved, it is desirable that these wearing surfaces be backed by a steel shell.

A low-carbon steel is formed into the outside profile required, heated to approximately 1350 F and coated with a flux of boron and soda ash. It is then rotated at 1000 to 1500 rpm depending on the diameter of the drum, and a measured quantity of molten gray iron is added. The carbon differential and the centrifugal force combine to insure an intimate weld between the gray iron and the steel.[39]

There are limitations to these processes. The method is limited to the production of annular or tubular shapes. In any combination of metals to be made by this method, the melting temperature of the outer layer cannot be much below that of the inner metal. This can at times be a serious limitation for certain design considerations. From the castability standpoint there is a limit to the thinness of the cast layers, particularly if the outer material is cast rather than formed.

Torch and Arc Cutting of Gray Iron

The application of torch and arc cutting to gray iron as an aid to fabrication has not as yet been extensive. In fact, gray iron cutting has been largely confined to salvage or dismantling operations and to the reduction of large scrap to sizes suitable for

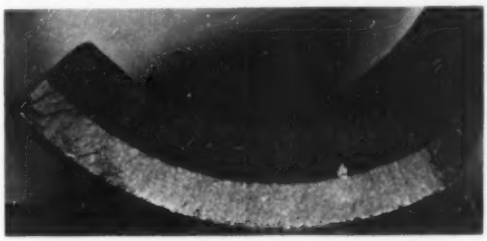


Fig. 25—Fracture of centrifugal cast tube shows hard alloy white iron surface bonded to gray iron core.

cupola charging. This limited application of torch and arc cutting to gray iron arises from two main facts.

First, the necessity for cutting does not arise as often in the case of gray iron as in the case of steel because of the design flexibility inherent in the casting process and the fact that small and medium size risers can normally be removed by the "nick and break" technique while they would have to be cut away in the case of cast steel.

The second, and possibly most significant, limitation is that until recently cutting processes in use for gray iron were slow, costly, and yielded a very rough and uneven cut. This latter difficulty is generally associated with a number of factors, i.e., the protection furnished the gray iron surface by graphite flakes, the dilution of the oxygen stream in oxygen cutting by carbon dioxide formed during oxidation of the graphite flakes, and the fact that the gray iron base metal has a lower melting point than the oxide slag produced in cutting so that a slag crust forms on the metal surface, protecting the metal underneath[19] from oxidation sufficient to sustain cutting.

These problems have been solved in recently developed processes either by the use of a flux, which increases fluidity of the slag, or by insuring that a high heat sufficient to melt the slag and allow the operation to continue uninterruptedly is generated.

It is to be expected that the uses of cast iron cutting —now largely limited to removal of lumps from ingot molds, removal of very large risers, cleaning up of riser pads, and scrap cutting—will be extended to facilitating production of gray iron assemblies or

altering the shape of existing castings, such as is now done to a limited extent in the case of pipe or rolls which are to be put to new applications.

1. Oxy-acetylene Methods: In the oxy-acetylene cutting methods the heat is provided initially by the combustion of acetylene and oxygen; after the casting has been preheated the oxygen is turned on full and the metal is burned out of the cut. The difficulties mentioned in the introduction to this section have been most successfully overcome in the oxy-acetylene process by two similar techniques.

In the first case, iron powder is injected into the cutting zone. The additional heat supplied by the

Fig. 26—Bimetallic brake drums are centrifugally cast with gray iron wearing surfaces and steel backing.

combustion of this powder raises the temperature of the base metal and of the slag so that no difficulty is encountered in making a continuous cut. The powder also exercises a fluxing and erosive action which facilitates cutting.

The surface at which the cut is to begin should be well preheated in the preheat flame of the cutting torch. On thick sections it is often advisable to begin the cut with an intermittent forward and back motion of the cutting torch until the slag has begun to emerge from the bottom of the kerf. The cutting may then proceed in a straight line. Lower cutting speeds and higher oxygen and powder flow are necessary on irons with high graphitic carbon or high alloy contents.[28]

An alternate method involves the injection of a non-metallic flux into the oxygen stream. This flux combines with the refractory oxides and lowers the melting point of the slag.[19, 24]

An older cutting method which was generally used on gray iron before development of the powder or flux variations employ only a standard oxy-acetylene cutting torch. It is a slower, more difficult process, but is valuable if only a few pieces are to be cut in that no special equipment is required. The surface where the cut is to be started and the line of the cut should be thoroughly heated with the preheat flame operating with an excess of acetylene.

In some cases it may be advisable to preheat the entire casting. Next, a semicircle ½ to ¾ in. in diameter at the starting point is heated until it is molten. The oxygen is then turned on full and the cut is begun with the torch at an angle of 45° to the workpiece. A swinging or oscillating motion must be used, and this motion is continued throughout the cutting operation. As the cut progresses the torch may be straightened until it is almost perpendicular to the workpiece, but this should not be done at the expense of losing the cut.

Special difficulties may be encountered with older methods. If the casting is of a type that is difficult to cut (either a high carbon or an alloy iron, or one containing excessive sands and slag inclusions) it may be advisable to use a steel rod melted in the flame as a flux. If the cut is lost, a small quantity of aluminum shot may be put in the kerf; the oxidation of the aluminum giving enough heat to remelt the iron.

On thin sections it is very difficult to carry on the cutting process continuously using this older method rather than the newer recommended methods, and a series of stops and starts, in which the process is begun again at the first step each time the cut is lost, may be necessary.[1, 47]

2. Arc Methods: Although they are infrequently used for gray iron cutting, arc methods offer some advantages in special cases. They do not produce as smooth a cut as do the oxy-acetylene methods, but they are more rapid, especially for the cutting of thin sections and round sections such as pipe. For most arc-cutting methods a minimum of special equipment is needed.

There are three arc-cutting techniques which have been successfully used on gray iron:

1. Carbon-arc cutting has been used with some success. A graphite electrode is preferred and special holders are necessary because of the high currents involved.[48]

2. Special flux-coated electrodes have been employed for cutting gray iron. One of the most useful of these employs a coating of thermit mix which provides additional heat to facilitate arc cutting.[35, 50]

3. The oxygen method, employing a hollow electrode, has also been used with considerable success in the cutting of pipe and other thin sections.[51] An arc is first struck and a small portion of the casting melted. A stream of oxygen is then directed at the heated area through the hollow electrode and cutting may proceed rapidly.[35, 48]

Acknowledgment

The author wishes to express his appreciation to the following companies for their courtesy in supplying the photographs used in this section of the article: Campbell Wyant & Cannon Foundry Co., Muskegon, Mich.; U. S. Pipe & Foundry Co., Bessemer, Ala.; Al-Fin Div., Fairchild Engine & Airplane Co., Farmingdale, N. Y.; The American Welding & Mfg. Co., Warren, Ohio; and Metal & Thermit Corp., New York.

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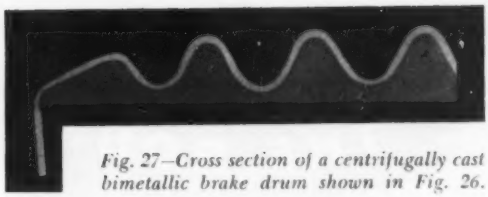

Fig. 27—Cross section of a centrifugally cast bimetallic brake drum shown in Fig. 26.

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Set Up Chicago Chapter Educational Course, Urge Immediate Enrollment

"SCRAP THE SCRAP PILE" is the theme of Chicago chapter's popular demonstration-discussion educational course being held again in early 1951. All sessions will take place in the auditorium of Peoples Gas Light & Coke Co., 122 S. Michigan Ave., Chicago. Meetings run from 7:30 to 9:30 p.m. Speakers and demonstrators have been chosen for their knowledge of foundry practice and their ability to present information in an informal, instructive manner. Dates and subjects are:

January 8—*"Better Quality Control Through the Laboratory"*
January 22—*"Modern Molding Methods"*
February 12—*"Modern Coremaking Methods"*
February 26—*"Improved Foundry Safety"*
March 12—*"New Methods of Gating"* features the latest color-sound A.F.S. research film on fluid flow.
March 26—*"Defective Castings and What to do About Them"*
April 9—*"Bonus Meeting"*—surprise meeting to be announced later.

Posters and enrollment blanks have been sent to all Chicago-area foundries. To register, send $1.00 and enrollment blank to Edwin H. Pritchard, Western Materials Co., 39 S. LaSalle St., Chicago 3, Ill.

Questions THE ROUND TABLE Answers

Lead Removal Not Practical

What are the possibilities of removing lead from a molten brass bath? We are aiming for less than one-third per cent.

There is no known practical or simple method to reduce the lead content of a molten brass bath, except by dilution. This requires addition of lead-free or practically lead-free alloy.

CLAUSEN A. ROBECK, *Vice-Pres.*
Gibson & Kirk Co.
Baltimore, Md.

Effects Of Sulphur and Manganese

Evidently sulphur or manganese by itself acts as a carbide stabilizer in gray iron, but when the two are in the iron together the net result is to cause graphitization. Please explain.

Both sulphur and manganese exhibit carbide stabilizing tendencies when added to gray iron. However, when both of these elements are added or exist simultaneously, they may or may not stabilize carbides depending upon the ratio of manganese to sulphur. Because of the affinity of manganese for sulphur, progressive additions of manganese to a melt having a given concentration of sulphur will tend to decrease the quantity of combined carbon and increase the graphitic carbon in the resulting iron. However, when the sulphur has been satisfied by the addition of sufficient manganese to react with it and form manganese sulphide, any excess manganese beyond this point exerts carbide stabilizing tendencies.

Specifically, in an iron containing approximately 0.12-0.14 per cent sulphur, as manganese is increased the combined carbon in the resulting iron reaches a minimum value when manganese has reached a concentration of approximately 0.55-0.60 per cent. Additional manganese, up to about 0.70 per cent in a pearlitic iron, will affect the matrix very little. With an increase up to about 1.00 per cent the matrix would be expected to become somewhat sorbitic. The iron becomes austenitic if manganese goes well above 10 per cent and silicon and carbon are low.

Coincidentally, the sulphur content of the iron decreases because the sulphur has reacted with the manganese to form manganese sulphide, a substantial portion of which has been eliminated from the melt as a slag. While the case cited applies to an iron containing a specific quantity of sulphur, a similar effect will occur with other sulphur concentrations, merely translating the curve to either the right or the left when combined carbon is plotted as the ordinate and manganese as the abscissa.

Pearlitic Malleable Annealing Cycle

We started making pearlitic malleable iron recently, melting in air furnaces a metal of the following composition: carbon, 2.4-2.6 per cent; silicon, 1.00-1.10; manganese, 0.7-0.9; sulphur, 0.08; and phosphorus, 0.03. What annealing cycle should we use?

The base metal you are producing seems to be quite acceptable for the production of pearlitic malleable iron provided that the silicon is adjusted so that the casting will be completely white as cast and totally devoid of primary graphite.

Beginning with this material, the annealing cycle must be varied ranging from a total of 40 hours, minimum, to a maximum of 60 hours, depending upon the section thicknesses in the castings being produced. If sections are in excess of 1 in. the longer cycle will have to be used. Generally speaking, the following cycle should give satisfactory results:

a. Six hours heating[6] to the soaking temperature.
b. 21 hours soaking at 1725 F.
c. Rapid cooling (4 hours) to a temperature of 1500 F.
d. Slow cooling to 1300 F and then air cool to room temperature.

This annealing cycle should yield castings which will range in Brinell hardness from 170 to 210 and contain essentially a pearlitic matrix with 5 to 10 per cent of free ferrite and a combined carbon of about 0.50 per cent. This material will have a minimum ultimate tensile strength of 70,000 psi, minimum yield point of 45,000 psi, and elongation of about 5 per cent in two inches.

It is highly desirable to control the time at the soaking temperature so that the final material will contain no primary carbides, since these are the cause of machining troubles and will reduce the ductility of the material and may also make the ductility erratic.

You will note we have indicated that the cycle outlined will produce a pearlitic malleable containing from 5 to 10 per cent of free ferrite. If it is decided that the matrix shall be wholly pearlitic, then it only becomes necessary to decrease the time interval necessary to cool from 1500 F to 1300 F, in order to lessen the tendency for second stage graphitization to take place.

MICHIGAN REGIONAL CONFERENCE FEATURES AIR POLLUTION PANEL

BASED ON THE THEME "New Trends in Foundry Development," the 1950 Michigan Regional Foundry Conference featured a full afternoon of discussion on air pollution, a session on gating, and papers on basic cupola operation, on Michigan State College research, and on education. The conference was again held at the college which co-sponsored the meetings November 10 and 11 with the Central Michigan, Saginaw Valley, Detroit, Western Michigan chapters, and the MSC student chapter of A.F.S. Co-chairmen of the conference were Austen J. Smith and C. C. Sigerfoos.

Jess Toth, H. W. Dietert Co., Detroit, opened the conference and presided throughout the morning of the first day. First speaker, introduced by Prof. Sigerfoos, was L. C. Price, head of mechanical engineering at MSC, who said that the regional foundry conferences impressed on students the possibilities for a career in the foundry industry, gave impetus to the formation of an A.F.S. student chapter, and aided in the development of the FEF program.

Engineering Dean Lorin G. Miller, in welcoming the conference to the college, commented on the increasing interest of the foundry industry in problems of ventilation and air pollution.

B. D. Claffey, Acme Aluminum Alloys, Inc., Dayton, Ohio, spoke on *"Trends in Foundry Education."* He discussed developments in high schools, trade schools, and colleges stemming from their cooperation with A.F.S. committees and chapters, individual foundrymen, and the Foundry Educational Foundation. Foundrymen should continue their efforts to provide information to educational institutions which will assist students in their choice of an educational program, he said.

In answering a question during discussion of his remarks, Mr. Claffey recommended plant visits for educators and students, and presentation of talks before high school classes on castings and the foundry industry as two good means of expanding interest in the castings industry.

The morning ended with S. F. Carter, American Cast Iron Pipe Co., Birmingham, Ala., presenting the results of work done in melting iron in a basic lined cupola. Object of the investigation reported was to study removal of phosphorus and sulphur in a cupola operating with a highly basic slag. In addition to the long-recognized desire to effect sulphur and phosphorus removal from iron, the recently developed nodular iron has placed further importance on low sulphur and phosphorus contents, he explained.

Reports On Cupola Research

In discussing the results of the investigation (A.F.S. TRANSACTIONS, vol. 58, pp. 376-392, 1950) conducted in a pair of 23-in. cupolas, one basic, the other acid, he pointed out that the basic heats experienced a greater silicon loss, a lower manganese loss, and a greater carbon pick up. Degree of desulphurization and dephosphorization is dependent on the slag, he said. Removal of sulphur calls for a basic, reducing slag; phosphorus reduction requires a basic, oxidizing slag. The speaker described the research operations in detail and stated that his company is now running a 36-in. basic cupola to obtain more production experience and more comparative data.

The entire afternoon was given over to an extensive discussion of all phases of air pollution. Chairman of the session was Jack F. Secor, Hill & Griffith Co., Niles, Mich. Coordinator of the panel discussion was Thaddeus Giszczak, Detroit, who arranged for the following

Air pollution symposium panel members study codes published in AMERICAN FOUNDRYMAN. *Left to right are: Chairman Jack F. Secor, Hill & Griffith Co., Niles, Mich.; J. M. Kane, American Air Filter Co., Louisville; George E. Tubich, Michigan Dept. of Health, Grand Rapids; Panel Moderator Thaddeus Giszczak, Detroit; K. E. Robinson, Michigan Dept. of Health, Lansing; A. H. Eichmeier, U. S. Weather Bureau, East Lansing, Mich.; and Forrest Strong, Michigan State. Symposium will appear in* AMERICAN FOUNDRYMAN *in 1951.*

speakers and subjects: *"Meteorology,"* A. H. Eichmeier, U. S. Weather Bureau, East Lansing; *"Plant Life and Pathology,"* Prof. Forrest Strong, Michigan State College; *"Public Health,"* K. E. Robinson, Michigan Dept. of Health, Lansing; *"Testing Procedures,"* George E. Tubich, Michigan Dept. of Health, Grand Rapids; *"Control Equipment,"* J. M. Kane, American Air Filter Co., Louisville, Ky.; and *"Legal Obligations."* Thaddeus Giszczak.

Mr. Eichmeier described the role of wind in removing air pollution from its source and diluting it. The other important meteorological factor, he declared, is convection which dilutes pollution by spreading it through a thicker layer of atmosphere if air temperature falls off with altitude. If temperature rises with altitude the air is stable and, in effect, clamps a lid on the area, allowing little widening of the pollution band. Pollution of the atmosphere can be minimized in a number of ways, he said, and suggested avoiding potential pollution problems through correct selection of sites for industrial installations.

Effect of Cupola Gases Described

Prof. Strong explained the physiological functioning of a plant and told how gases discharged by cupolas can influence plant life. Sulphur dioxide and fluorine compounds are the most common offenders, he declared. Injury by sulphur dioxide is increased through moist air, high temperatures, and low wind velocities and may occur well below the concentration troublesome to humans. Lack of rainfall aggravates injury from fluorine compounds, he said.

Materials which may be in the air in a foundry, according to Mr. Robinson, include silica, carbon monoxide, lead, zinc, and cupola wool. Whether silica is a health hazard, he said, depends on particle size and concentration, and exposure. Concentrations of carbon monoxide may occur at the cupola during light up and in pouring areas. Zinc and lead generally result from melting operations with lead concentrations also possible in painting areas.

Mr. Tubich demonstrated and described sampling equipment used for two classes of air contaminants, (1) particulate matter (includes fume which is condensation of vaporized metal), and (2) gases. In sampling particulate matter, he said, great care must be exercised to collect with high efficiency the particles smaller than 10 microns (one micron is 0.00003937 in.). Such material, the previous speaker had explained, presents the greatest problem in air pollution. Mr. Tubich declared there is room for development of better sampling and testing equipment, for learning more about effects of air pollutants, and for improvement in foundry techniques causing contamination.

Mr. Kane divided air contamination into two types—public nuisance and air pollution, with 10 microns the partical size boundary line between the two. He reviewed the problems resulting from the carry over of regulations and standards established for boiler fly ash and smoke control into the broader, more complex field of industrial process emission control. Mr. Kane described in detail all the various types of equipment available to the foundry industry and explained applications, advantages, and disadvantages.

The symposium concluded with a summary by Mr. Giszczak of some of the codes and ordinances existing in various parts of the country.

Speakers at the dinner concluding the first day of the conference were A.F.S. Secretary-Treasurer Wm. W. Maloney and C. W. Otto, Lansing Chamber of Commerce. Howard H. Wilder, Vanadium Corp. of America, Detroit, was chairman.

Mr. Maloney said that the problem of education and training has been with the industry for more than the past few years during which so much emphasis has been placed on personnel development. To meet the high demands of the next decade foundrymen must train personnel extensively. Another important step to be taken is to improve housekeeping, he declared, and he asked how many foundries live up to the A.F.S. slogan "The Foundry is a *Good* Place to Work."

Visits to 11 European countries by means of a "flying classroom" were described by Mr. Otto. He told how he and 65 American educators flew to and about Europe to study conditions by meeting with leading educators, government officials, minority party leaders, labor leaders, and Marshall plan officials.

Two films on gating, a film on dust and fume hoods, and a report on Michigan State College research filled the program the morning of the second day and concluded the Conference. The first film was the color-sound film on fluid flow reporting the second stage of the A.F.S. research project guided by the Aluminum and Magnesium Division's Research Committee.

Prof. H. L. Womochel described recent studies on the effectiveness of inoculants, a continuation of his last year's report. Microstructures and mechanical properties indicate, he said, that calcium silicide is the best of those studied, while silico-manganese caused no improvement and was possibly detrimental.

Discusses Finger Gating

W. H. Johnson, Naval Research Laboratory, Washington, D. C., discussed finger gating and showed a film made in the Naval Research Laboratory illustrating the behavior of molten steel in six types of finger gating systems. (AMERICAN FOUNDRYMAN, April 1950, page 106.) Similarity in behavior of various casting alloys was shown in slides which demonstrated that differences are due primarily to differences in skin forming and drossing tendencies.

K. E. Robinson provided the commentary for a short film illustrating the effectiveness and proper use of various types of dust and fume hoods to conclude the conference.

The Planning Committee for the Michigan Regional Foundry Conference, in addition to co-chairmen Smith and Sigerfoos, were: Donald D. Bowman, Almont Mfg. Co., Almont; Stanley H. Davis, Campbell, Wyant & Cannon Foundry Co., Muskegon; Robert D. Dodge, Archer-Daniels-Midland Co. (Werner G. Smith Co. Div.), Detroit; Thaddeus Giszczak, Detroit; Russell J. Kleis, Michigan State College; Robert W. Mason, Jr., International Nickel Co., Detroit; F. James McDonald, Central Foundry Div., General Motors Corp., Saginaw; Richard K. Moore, Foundries Materials Co., Coldwater; Prof. L. C. Price; Prof. H. L. Womochel; Fred W. Schwier representing the MSC student chapter; and Ross P. Shaffer, Lakey Foundry & Machine Co., Muskegon.

CORE SAG CONTROLLED

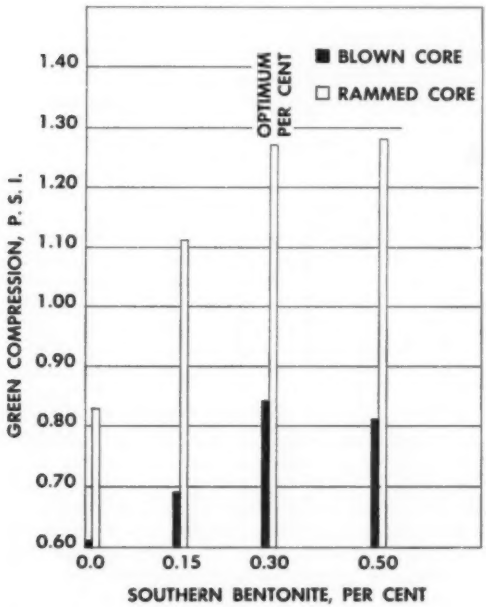
Tom Barlow
Sales Manager
Eastern Clay Products, Inc.
Jackson, Ohio

BENTONITIC CLAYS have been used in the coreroom with commercial success for years. Properties, advantages, and disadvantages are reasonably well established. However, within recent years there has been a definite trend toward southern bentonite in the corerọom. Its effect on oil-sand cores is quite different from that of western bentonite and, in spite of the fact that southern bentonite is now widely used by large production corerooms, its special properties have not been discussed in the literature of the industry.

At first, southern bentonite was substituted for western bentonite to obtain higher flowability. It soon became evident, however, that southern bentonite had effects which were not obtained from other binders and it is no longer considered a substitute for western bentonite; it is a new and unique coreroom material.

Southern bentonite is used to control the sag of green oil-sand cores. Once it found merit principally because it reduced core loss caused by rough handling of green cores. Now its use has been extended to permit changes in the number and location of wire reinforcements. Foundrymen have discovered that the judicious use of southern bentonite permits a substantial reduction in the number of wires used per core. In many cases, such wires have been completely eliminated. In a few cases it has been possible to eliminate driers. These changes permit substantial increases in coreroom production in addition to reducing core breakage.*

Fig. 1—The effect of southern bentonite on green strength is plotted for oil-sand cores. Core mixture: 1360 grams lake sand; 600 grams bank sand; 10 grams cereal; 20 grams ASTM linseed oil; 2.6 per cent moisture.



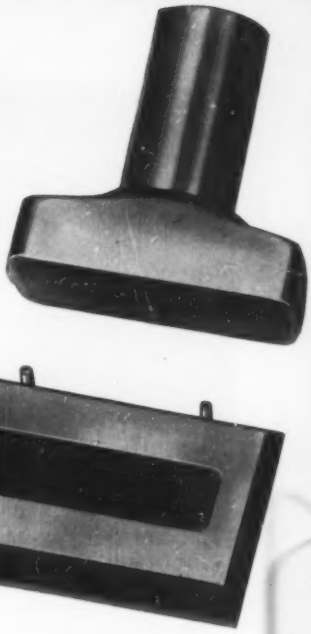


Fig. 2—The sand cartridge (right) and the core blowability box (below) are used to determine the relative blowability of core sands.

"Mobility" of Core Sands: For many years the usual coreroom laboratory tests included green compression, permeability, tensile strength, and hardness. Interest in additional tests has been promoted by the rapid growth of core blowing equipment and the new problems which it presented. Core blowing increased the use of non-pasted or integral core assemblies blown in one piece. This activity emphasized the fact that oil-sand cores do differ in some properties not measured by the usual laboratory tests. For example, there seems to be a difference between flowability and blowability. Some core sands work very well in handmade cores but do not blow well in production core blowers.

Another property not normally measured was sag or "mobility." Production cores showed wide variation in their ability to hold overhanging sections, although the green strength was held to the usual figure. It was found that the failure through sag or slump could be minimized by increased green strength. However, there was no direct relationship between green strength and sag in the cores.

Some outstanding examples of mobility during some earlier research work with special resin binders have been observed. It was found that some combinations of binders showed an exaggerated tendency toward sag and slump. In one commercial test with a new binder, so much mobility was found that the cores

*Because of the lack of laboratory information on this practical application of southern bentonite, Eastern Clay Products instigated a program of research with the H. W. Dietert laboratories. The data developed help to explain the mechanism by which southern bentonite aids in the production of intricate core assemblies. The accompanying photographs were furnished by the H. W. Dietert Co., Detroit.

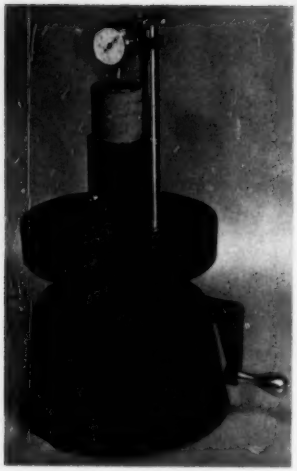


Fig. 3—Green core impact tester is shown set up for measuring the sagging resistance of a 2 x 2 in. core specimen. Slump is measured by the dial indicator as the specimen is jolted by one or more drops of 0.08 in.

could not carry their own weight for more than a few minutes, even with green strength greater than 2 psi.

Some cylinder barrel cores were blown with this binder with apparent success—at first. However, the cores would slump and revert to a pile of sand before they could be placed in the oven. This case was exaggerated because the green strength of the cores was more than twice that normally used for the same application in the standard mix.

Most examples of mobility are not as obvious as that described above, but they do constitute a real problem in the foundry. For example, certain cores require excessive wire reinforcing to maintain the correct alignment of an overhanging section. In other cases there is sufficient sag to change the final dimensions of the core and cause it to be rejected. These difficulties are usually met by special driers, wires, or other reinforcing. These same problems have caused some foundries to handicap production by maintaining high green strengths in spite of the fact that high strength makes core blowing difficult and exacting. Excessive green strength also promotes gas formation and increases the danger of defective castings.

Our research work indicated that small additions of southern bentonite had a pronounced effect on reducing mobility in special applications. The commercial acceptance of this product today indicates that the same characteristic is of value in ordinary oil-cereal combinations.

Tests for Mobility: At present there are three laboratory tests which correlate with practice in evaluating the resistance to sag or slump. All three tests are based on applied impact or shock. One test uses a simple cylindrical core. The sand is appraised on the basis of the number of shocks necessary to crack the specimen. The second test is similar but uses a core specimen which includes an overhanging section. In the third test, the specimen is jarred a predetermined number of times. The shock is not sufficient to fracture the specimen but is sufficient to produce a measurable slump or sag.

These three tests cover the commercial problems of (1) overhanging sections without support, (2) careless handling of green cores, (3) bumping on a conveyor or transporting truck, and (4) sag of unsupported heavy core sections before baking. These problems are more acute in blown cores, so the test specimens include both handmade and blown cores.

Green Strength vs. Southern Bentonite: Southern bentonite is similar to western bentonite in that both increase the green strength of oil-cereal cores. Its effect is shown in Fig. 1, which covers tests made with a typical

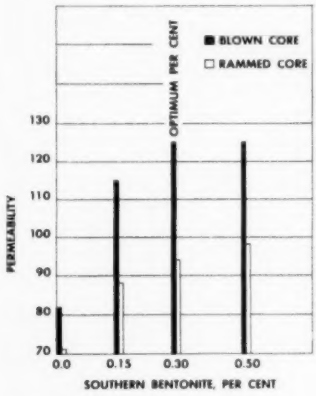


Fig. 4—The effect of southern bentonite on permeability is plotted for oil-sand cores maintained at constant green strength of 1 psi. Core mixture: 1360 grams lake sand; 600 grams bank sand; 20 grams ASTM linseed oil; 2.7 per cent moisture.

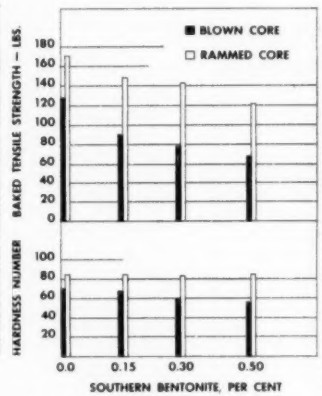


Fig. 5—Effect of southern bentonite on indentation hardness and baked tensile strength is plotted for oil-sand cores. Core mixture; 1360 grams lake sand; 600 grams bank sand; 10 grams cereal; 20 grams ASTM linseed oil; 2.7 per cent moisture.

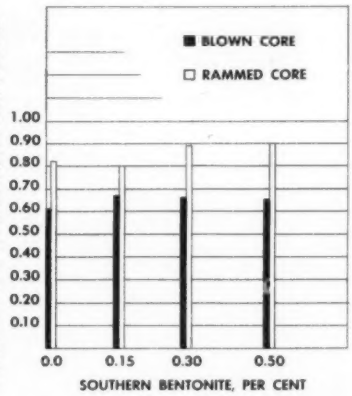


Fig. 6—Plotted test results show increases in blowability and flowability of blown and rammed oil-sand cores with additions of southern bentonite. The green compression strength of the cores was maintained at 1 psi. Core mixture: 1360 grams lake sand; 600 grams bank sand; 20 gm. linseed oil; 2.7 per cent moisture.

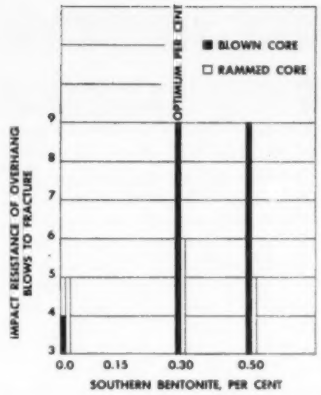
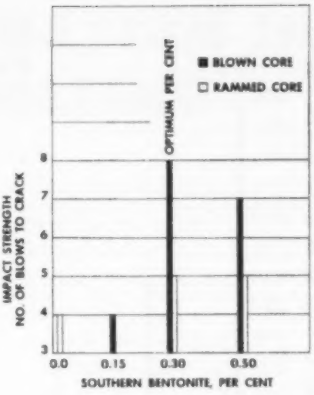


Fig. 7 (left)—Various additions of southern bentonite to blown and rammed oil-sand cores resulted in increased impact strengths of overhanging core sections. Core mixture: 1360 grams lake sand; 600 grams bank sand; 10 grams cereal; 20 gm. linseed oil; 2.7% moisture.

Fig. 8 (right)—Resistance to cracking on repeated dropping is increased in blown and rammed oil-sand cores containing various amounts of southern bentonite. Core mixture: 1360 grams lake sand; 600 grams bank sand; 10 grams cereal; 20 grams ASTM linseed oil; 2.7 per cent moisture.



core mix of lake sand (A.F.S. Fineness, 48), bank sand (Fineness, 90), ASTM linseed oil, cereal, and 2.6 per cent water. In this test 0.3 per cent southern bentonite provided optimum properties with larger additions showing no appreciable increase. The increase in green strength was most noticeable in the handmade cores but the percentage increase in green strength was comparable for both types of specimens.

Although green strength is not the determining factor in the use of southern bentonite in the coreroom, it does apply where high green strength is desired.

Permeability vs. Southern Bentonite: Any dry material added to a core-sand mixture would be expected to reduce the permeability by closing the voids between the sand grains. Therefore, in establishing the data plotted in Fig. 4 the cereal content was progressively reduced to maintain a constant green strength of 1.0 psi. This technique permits an evaluation of southern bentonite in relationship to the permeability at constant green strength. On the basis of these tests southern bentonite improves permeability, with 0.32 per cent the optimum addition.

Tensile Strength and Hardness vs. Southern Bentonite: It is generally recognized that most forms of clay have an adverse effect on the baked tensile strength and hardness of oil-sand cores. In the case of southern bentonite, this effect is minor in small percentages, particularly as regards hardness. However, there is a change in the tensile strength which must be allowed for in those applications actually requiring a specified strength. In many cases, no compensation is made, either because the strength is higher than needed originally or because hardness is the governing factor.

Figure 5 summarizes the effect of southern bentonite on both tensile strength and hardness. The slight reduction in hardness can probably be ignored even at the low hardness level used in these tests. In cores with higher oil ratios used to promote maximum hardness, the effect of southern bentonite is even less apparent.

One point of interest illustrated by Fig. 5 is the slight differential between additions of 0.15 per cent and 0.30 per cent southern bentonite. On the basis of these tests, there is no reason for not using the higher percentage to obtain other desirable properties since the effect of large and small additions upon the tensile strength is approximately the same.

Blowability vs. Southern Bentonite: Although it is generally conceded that there is a difference between flowability and blowability, southern bentonite can be expected to have about the same effect on both properties. This was confirmed by the data summarized in Fig. 6. The effects of the two tests were similar but to different degree.

Since southern bentonite increases green strength rather rapidly, it was necessary in these tests to maintain a constant green strength by reducing the cereal with increasing additions of clay. Otherwise the test would have indicated the relationship between green strength and flowability instead of the relationship between southern bentonite and flowability.

Figure 6 demonstrates a rather marked increase in both flowability and blowability in the presence of 0.30 per cent southern bentonite. However, blowability differed from flowability in that the maximum results were obtained with 0.15 per cent southern bentonite. In all cases, the improvement is about 10 per cent.

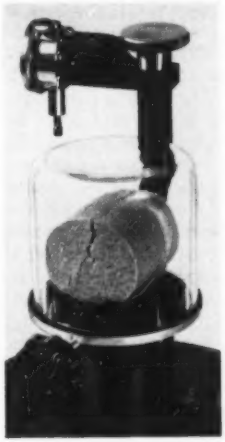
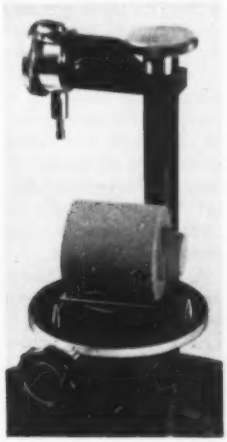


Fig. 9—Impact tester arranged for measuring oil-sand core resistance to cracking and spreading.

Fig. 10—Testing machine set up for determining the impact resistance of oil-sand core overhang.



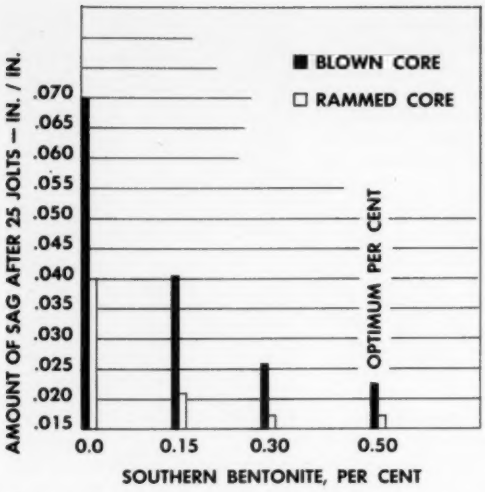


Fig. 11—Effect of southern bentonite additions in reducing sag or slump in oil-sand cores. Core mixture: 1360 grams lake sand; 600 grams bank sand; 10 grams cereal; 20 grams linseed oil; 2.7 per cent moisture.

The first test for mobility is reported in Fig. 7. This test measures the ability of a core to maintain an unsupported section without failure from handling or jarring. The results are most spectacular with blown cores, while with handmade cores the effect is noticeable but much smaller. The marked improvement in blown cores helps explain why foundrymen have been able to reduce the wires in unsupported core sections when the correct percentage of southern bentonite is used. Some foundries are using 0.50 per cent for some jobs. Their experience seems to indicate that this percentage is advisable, but the laboratory tests covered by Fig. 7 indicate that 0.30 per cent is just as effective.

Impact Strength Improved

Figure 8 shows the pronounced effect of southern bentonite on impact strength. The effect is particularly marked in blown cores, and is noticeable even in hand-rammed cores. Optimum percentage is again 0.30 per cent. As shown in previous tests, larger percentages are not noticeably beneficial. This type of test should indicate the ability of a green core to withstand the bumping and jolting on conveyors or handling on and off core racks and trucks. Its practical application is found in a reduction in the number of wires and in some cases a reduced need for driers. On jobs that cannot be satisfactorily wired to withstand handling, southern bentonite results in a definite reduction in green core breakage.

A similar test is shown in Fig. 11. In this test the cores are jolted 25 times but the jolt is not sufficient to fracture the core. The impact is sufficient to cause a measurable slump or sag. This effect, like the preceding test, indicates what happens when green cores are handled or transported. This test, however, correlates with those cases in which the shock is sufficient to distort the core but not enough to break it. In practice, the off-size core may be caught by inspection and scrapped or it may go into production and show up as a scrap casting.

Figure 11 indicates that southern bentonite has a very marked effect on sag. Even 0.30 per cent southern bentonite reduced the sag to one third the amount found in the original oil-cereal mix. The larger addition of southern bentonite further reduced the sag but not sufficiently to warrant the added cost.

The effect of southern bentonite on sag was most pronounced in blown cores, but even in hand-rammed cores it reduced the sag by more than 50 per cent. In many cases that would be the difference between a good core and a bad one—between a good casting and a scrapped casting.

Summary

The use of southern bentonite in the coreroom is now established practice. Its principal function is to control the impact properties of green cores. This property of southern bentonite has resulted in (1) reduction in number of cores scrapped for sag and distortion, (2) reduction in broken cores, (3) reduction in number of wires required per core, and (4) in rare cases, elimination of core driers.

The effect of southern bentonite in reducing the mobility of oil-sand cores and increasing impact strength is confirmed by laboratory investigations using three different types of impact and sag tests. On the basis of these tests, the optimum percentage of southern bentonite for most applications is 0.30 per cent. For maximum resistance to impact, no other change is made in the core mixture. The other properties are changed as follows: (1) green compression strength increases; (2) permeability increases; (3) flowability remains essentially constant; (4) stickiness decreases; (5) baked tensile strength decreases; (6) hardness remains constant.

Future Meetings and Exhibits

MALLEABLE FOUNDERS' SOCIETY, semi-annual meeting, Hotel Cleveland, Cleveland—Jan. 19, 1951.

WISCONSIN REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Wisconsin Chapter and University of Wisconsin, Schroeder Hotel, Milwaukee—Feb. 8-9, 1951.

A.I.M.E., annual meeting, Jefferson Hotel, St. Louis—Feb. 18-22, 1951.

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Birmingham District Chapter, Tutwiler Hotel, Birmingham, Ala.—Feb. 22-23, 1951.

AMERICAN SOCIETY FOR TESTING MATERIALS, committee week, Netherland Plaza Hotel, Cincinnati, Mar. 5-9, 1951.

OHIO REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Northeastern Ohio, Cincinnati District, Toledo, Canton District, Central Ohio, and Ohio State University Student Chapters, at Case Institute of Technology, Cleveland—Mar. 8-9, 1951.

WESTERN METAL CONGRESS AND EXPOSITION, Civic Auditorium, Oakland, Calif., Mar. 19-23, 1951.

55th Annual Foundry Congress, American Foundrymen's Society, Buffalo, N. Y.—Apr. 23-26, 1951.

AMERICAN SOCIETY FOR QUALITY CONTROL, annual convention, Hotel Cleveland, Cleveland, May 23-24, 1951.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J., June 18-22, 1951.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, the Homestead, Hot Springs, Va., June 21-22, 1951.

BETTER SULPHUR ELIMINATION IN BASIC OPEN HEARTH MELTING

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Canadian Car & Foundry Co., Ltd.
Montreal, Que.
Canada

AN INCREASED SCAP LOSS due to hot tears and cracks occurred at the Longue Pointe steel foundry in 1949. The castings accounting for this increase were usually of thin section such as spring planks, bolsters, and side frames made in green sand. Immediately an investigation was started to determine and eliminate the cause of these hot tears and cracks.

The mechanism by which hot tears occur, as reported in the literature, was studied in the hope of finding the solution to the problem. Stress concentration in heavy sections, which would be weakest shortly after pouring, hindered contraction, and aluminum sulphide eutectic inclusions and sulphur content, both of which reduce strength at high temperatures, were considered.

After a few changes in the foundry practice it was decided to look for the cause of the hot tears in the metal composition. Upon examination of the chemical analysis of the steel it was noticed that the sulphur content was higher than it had previously been and it was decided that this was probably the cause of the trouble. The sulphur increase was attributed to high-sulphur scrap.

This called for a program of sulphur removal. It was felt that lower sulphur could be obtained through charging less sulphur into the furnace and through a closer control of the slag composition.

With the slag control developed it is possible to produce steel with a sulphur content of below 0.03 per cent. The average sulphur of the open hearth steels, produced at the Canadian Car and Foundry Co., Longue Pointe plant, is approximately 0.026 per cent, and is progressively decreasing due to the cumulative effect of the decreasing sulphur content of the open hearth returns used in the charge.

Sulphur removal in the basic open hearth takes place when iron sulphide reacts with lime and manganese oxide according to the following reactions:

$$FeS + CaO \rightleftharpoons CaS + FeO$$

$$FeS + MnO \rightleftharpoons MnS + FeO$$

These reactions occur because a good part of the metallic sulphides are present in the slag and can react as shown. With high CaO and MnO and low FeO and MnS these refining reactions tend to proceed to the right.

Factors promoting low-sulphur steel are the following: (1) high bath temperature and fluorspar; (2) high slag basicity; (3) low iron oxide; (4) high desulphurization ratio; (5) high slag volume; (6) high residual manganese; (7) low sulphur in the charge.

NOTE: This paper is one of the 1950 prize winners in the Annual Technical Paper Contest sponsored by the A.F.S. Eastern Canada Chapter.

High bath temperature gives a slag with good activity and good fluidity. Fluidity is also increased by fluorspar. A good mature slag will dissolve approximately 0.2 per cent sulphur by weight.

High slag basicity is required for it is a sure way of having a slag of high CaO and MnO content. Advantage of high slag basicity (high pH value) is shown by the graph of sulphur in steel vs. pH of slag shown in Fig. 1 plotted from actual results obtained.

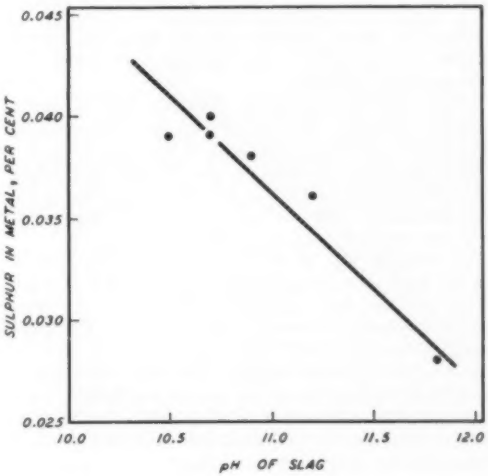
To determine pH the slag sample is ground in a percussion mortar to pass through a 100-mesh screen. A 0.2–gram sample of this powder is added to 100 ml of water, and after shaking is allowed to stand for 10 min. At the end of the 10 min the pH of the solution is determined by means of a Beckman pH meter. Total time required is about 15 min.*

The desulphurization ratio is defined as the ratio of the percentage of sulphur in the slag to the percentage of sulphur in the steel. Since high CaO and MnO are favorable to sulphur elimination, the desulphurization ratio should increase with increasing CaO and MnO content in the slag, and also with increasing pH. This is shown experimentally by values taken during a heat, the results of which are shown in Fig. 2. Theoretically, since the graph shows a straight line relationship, it would be of great advantage to have a slag of very high pH.

Low FeO in the slag is desired because according to

*The pH is determined by the slag suspension method suggested by W. O. Philbrook and A. H. Jolly, Jr., of the International Harvester Co. A description of the method is given in "A Survey of Slag Control Methods," AIME *Open Hearth Steel Proceedings*, 1944, p. 233.

Fig. 1.—Sulphur percentage in metal vs. pH of the slag plotted from data obtained during the investigation.



the law of mass action better sulphur elimination will result in the reaction: $FeS+CaO \rightleftarrows CaS+FeO$. That is, the reaction will go more completely to the right when the FeO is low. Low FeO is also necessary to maintain high residual manganese.

Since it is advantageous to have low FeO for sulphur removal, the working of the heat to obtain good sulphur removal should be started as early as possible after melt down. At the beginning of the heat the carbon is high and the FeO low. As the heat progresses the oxidizing power has to be increased in order to

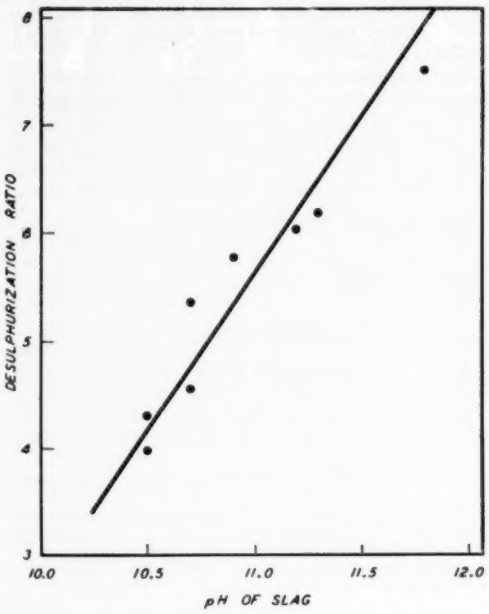


Fig. 2—Desulphurization ratio vs. pH of the slag plotted from data obtained during an open hearth heat.

reduce the carbon content. At this point the FeO is higher and it would be considerably more difficult to effect sulphur removal.

High residual manganese does not lead to better sulphur removal. The function of the residual manganese is to combine with part of the sulphur that is left in the steel to form the less harmful manganese sulphide inclusions. When the residual manganese is not present in a sufficient quantity then the more harmful iron sulphide inclusions may form.

An obvious way to obtain a lower sulphur content in the steel is to charge less sulphur into the furnace. This calls for raw materials such as fuel, pig iron, scrap, limestone, dolomite, iron ore, etc., of a lower sulphur content. But here economics must not be overlooked, for lower sulphur materials mean higher price, and in some cases they are not available. Therefore, an economic balance must be kept between price of low sulphur raw materials and time and material employed for better sulphur removal.

The factors that help sulphur removal have in most instances well defined limits that stem from practical and theoretical reasons. The combination of the limits of these individual factors is the criterion that will determine the percentage of the total sulphur charged that it will be possible to eliminate under these conditions. Knowing the percentage of the total sulphur charges that will be eliminated enables the melter to determine how much sulphur it is permissible to charge in order to produce a heat of specified sulphur content.

The bath temperature is limited, for one thing, by the fact that open hearth furnaces have silica brick roofs which can stand temperatures of about 3000 to 3100F. The roof is operated with a very slight margin of safety (about 200F) and, consequently, a slight rise in temperature may result in a bath full of roof.

Limit Slag Volume

To increase the slag basicity and consequently the pH, lime must be added to reduce the effect of the acid constituents such as SiO_2, P_2O_5, etc., present in the slag. The addition of lime in quantity raises the slag volume as well as its viscosity. There are many reasons why the slag volume may not be greatly increased. The first is purely physical—the size of the furnace. Too great an increase would soon have the slag overflowing the breast of the furnace.

The second reason is that with too thick a layer of slag over the metal bath, there is a blanketing effect. This blanket insulates the metal bath from the heat and oxygen required for the refining operation, thus lengthening the heat. This increases the danger of a cold heat. The viscosity of the bath cannot be increased too markedly either, for a viscous slag has but little bath action and thus poor refining qualities.

From values obtained during the investigation it was determined that a pH of 11.4 to 12.0 gives good results for all factors involved.

Since there is a limiting value to which the pH of a slag can be raised, and since the desulphurization ratio increases with the increasing pH, there is also a limiting value to the desulphurization ratio obtainable. The desulphurization ratio being thus limited, it is readily seen that the amount of sulphur it is possible to remove will also be limited. The graph of desulphurization ratio vs. pH (Fig. 2) shows that the desulphurization ratio will range from 7.5 when the pH is 11.4 to 10.0 when the pH is 12.0 The maximum obtainable value for the ratio is thus 10.0.

The ratio of the total sulphur content of the slag to the total sulphur content of the steel is obtained by multiplying the desulphurization ratio by the ratio of the slag weight to the metal weight. That is:

$$\frac{\text{weight slag}}{\text{weight metal}} \times \frac{\%\ \text{S (slag)}}{\%\ \text{S (metal)}} = \frac{\text{weight S (slag)}}{\text{weight S (metal)}}$$

desulphurization ratio. This shows that for a given desulphurization ratio the higher the slag volume the more sulphur will be eliminated. The slag volume cannot be increased very much for the reasons stated in discussing slag basicity. The maximum ratio of slag weight to metal weight that has been found practical for operation is in the neighborhood of 0.10.

The maximum ratio of total sulphur in the slag to

LOG OF OPEN HEARTH HEAT NO. 5382 (JULY 12, 1949)

Time	Bath Additions	Test	Metal Composition, % Si	Mn	P	S	C	pH	Slag Composition, % S	P	P_2O_5	Fe	FeO	MnO	CaO	SiO_2	CaO / SiO_2
13:15	10 CaF_2																
13:22		1	0.03	0.28	0.0147	0.030	0.81	10.6	0.120	0.94	2.16	8.1	7.7	12.1	44.3	13.7	3.08
13:24	100 Ore																
13:26	35 CaF_2																
13:33		2	0.03	0.28	0.0108	0.031	0.61	11.8	0.120	0.75	1.72	13.6	13.6	8.1	49.6	14.0	3.54
13:38	40 CaF_2																
13:43		3	0.03	0.26	0.0054	0.030	0.60	11.0	0.150	0.94	2.16	11.6	11.0	9.6	49.3	14.1	3.50
13:53		4	0.03	0.24	0.0100	0.030	0.51	11.2	0.160	0.94	2.16	11.3	9.3	7.9	52.1		
13:55	200 Spiegel																
14:03		5	0.03	0.32	0.0054	0.029	0.40	11.3	0.170	0.83	1.90	11.6	11.5	7.3	52.7		
14:13		6	0.03	0.29	0.0046	0.029	0.35	11.4	0.140	0.76	1.74	12.9	13.2	7.9	51.0	10.7	4.77
14:17	25 Si-Mn																
14:23		7	0.03	0.24	0.0092	0.028	0.32	11.4	0.220	0.72	1.65	12.4	12.6	7.6	54.0	15.4	3.50
14:30	200 Fe-Mn																
14:33		8	0.03	0.43	0.0085	0.027	0.26	11.5	0.210	0.63	1.44	12.3	12.6	8.2	53.9	11.5	4.67
14:35	Tap																
14:49		9	0.43	0.74	0.013	0.027	0.26										
15:01		10	0.51	0.74	0.015	0.026	0.26										
15:10		11	0.50	0.73	0.017	0.028	0.26										
15:20		12	0.47	0.74	0.019	0.029	0.26										
15:35		13	0.41	0.78	0.027	0.030	0.26										
15:42		14						10.7	0.210	0.46	1.06	7.1	9.3	7.9	24.0		

CHARGE:			Additions at Tap:	
	Basic Pig Iron, lb	15,000	Ferrosilicon, lb	50
	Scrap Rails, lb	11,700	Electro Silicon, lb	574
	Plate, lb	14,000	Calcium Silicide, lb	63
	Open Hearth Returns, lb	11,800	Aluminum, lb	70
		52,500		
	Burnt Lime, lb	3,500		

the total sulphur in the steel is obtained when both the maximum desulphurization ratio and the maximum ratio of slag weight to metal weight exist. With a maximum desulphurization ratio of 10.0 and maximum ratio of slag weight to metal weight of 0.10, the maximum ratio of sulphur weight in the slag to sulphur in the metal is 1 to 1. Therefore, at best only 50 per cent of the sulphur charged can be eliminated.

The low FeO required for better sulphur elimination is in direct contradiction to the high FeO required for phosphorus removal. Since phosphorus elimination is a prime reason for using a basic open hearth, the FeO cannot be lowered too much. In addition, too low an FeO content will cause slow carbon oxidation thus prolonging the refining period, which is costly.

As a result of this investigation the procedure now followed for the making of a heat is as follows:

As soon as possible after melt down a metal sample is taken and analyzed for sulphur. If the sulphur content is high, say 0.045, then steps are taken to start the sulphur eliminati n immediately while the oxidation is still low (FeO, 7.0 to 8.0 per cent).

A slag sample is taken soon after this and the pH determined. At this point a pH of 11.4 is hoped for but not always obtained. The pH may be 10.8 or 11.0, but this should not cause undue alarm as it can be rectified by the addition of lime. The pH of the slag is taken at numerous instances during the progress of the heat to make sure the basicity is increasing.

The ladle in which the metal is tapped is held for about an hour. This is from the time the heat was tapped to the time the last casting is poured. The slag in contact with the metal must be of such condition as to cause the least change in the metal composition during the pouring time. The slag obtained with present practice is one that will give these conditions. An example of this is shown by the accompanying log sheet of an open hearth heat.

International Foundry Dictionary Committee Meets In Buxton, England

REPRESENTATIVES OF SEVEN NATIONS met June 6 in Buxton, England to finalize plans for an international foundry dictionary. A general layout of the volume was presented to the committee and approved. The dictionary, in final form, will include an extensive glossary in each of several major languages.

Attending the meeting were Chairman Mario Olivo and E. Mortara of Italy; M. Blanc and A. Brizon of France; A. B. Everest of England; J. Fulton and J. Lamoreux of Belgium; Erik O. Lissell and J. Drachmann of Sweden; R. Resitsema and F. W. E. Spies of the Netherlands; and Vincent Delport, representing the United States.

Correction

In the article *"Notch Sensitivity of Various Materials"* by T. E. Eagan, AMERICAN FOUNDRYMAN, November 1950, page 22, the per cent reduction of endurance limit of ductile cast iron should appear in Table 1 as 23.0 per cent instead of 18.5 per cent.

GALVANIZING CHARACTERISTICS

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PHYSICAL CHARACTERISTICS and general properties of any galvanized coating are influenced by many factors, among which chemical composition and type of base material are of major importance. The investigation reported here consists of a study and comparison of galvanizing characteristics of malleable and gray cast irons with a number of miscellaneous steels included. Galvanized coating properties evaluated for the various materials were: (1) appearance of coating, (2) thickness of coating, (3) weight of coating, and (4) weight loss of test samples.

A total of 10 different irons and steels were prepared for this investigation, including two gray cast irons, two malleable irons and six steels from as many different heats. The gray and malleable iron samples, from individual melts, represented extremes of composition used in commercial practice in one plant.

The steels were picked from individual heats and represented rimmed, semi-killed and killed types. These steels were included mainly for comparison purposes, since their galvanizing characteristics were reported upon in previous investigations [1 2 3]. Chemical compositions of various iron and steel samples are listed in Table I.

Originally, it was planned to galvanize rough castings of gray iron and malleable — the castings being of special size and shape designed for this investigation. It was found, however, that very erratic results were obtained with castings from the same mold, due to variations in surface smoothness caused by varying sand conditions in different locations in the mold.

Since the surface condition with respect to roughness had considerable influence on coating weight and appearance, it was found impractical to attempt to correlate data obtained from test samples of this type. Therefor, in order to eliminate the effects of such variables, it was decided to cut and prepare square, smooth test specimens — all of identical size, shape and surface smoothness. The cut specimens were precision ground to give identical, highly-polished surfaces, the overall dimensions being ½ in. x ½ in. x 6 in.

TABLE I — MATERIALS — MALLEABLE, GRAY CAST IRON, STEEL

Sample	Type	Composition, per cent				
		C	Si	Mn	S	P
1	Malleable	2.52	1.35	0.47	0.133	0.056
2	Malleable	2.32	1.12	0.47	0.098	0.061
3	Gray Cast Iron	3.39	1.70	0.47	0.092	0.504
4	Gray Cast Iron	3.46	2.19	0.50	0.105	0.552
A	Steel, semi-killed	0.19	0.055	0.38	0.038	0.026
B	Steel, semi-killed	0.28	0.095	0.55	0.035	0.028
C	Steel, semi-killed	0.36	0.115	0.54	0.030	0.023
D	Steel, killed	0.55	0.140	0.72	0.042	0.027
E	Steel, killed	0.82	0.190	0.97	0.030	0.022
F	Steel, rimmed	0.08	0.009	0.31	0.029	0.014

Experimental Galvanizing Procedure

In order to galvanize all of the test samples in an identical manner, it was necessary to place them in a specially constructed rack which held all of the samples vertically and which could be manipulated by an overhead hoist. By this means the rack could be lowered into and removed from the spelter with all the specimens held in the same vertical position. The racks were removed from the spelter

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NOTE: This paper was presented before the semi-annual meeting of the Hot Dip Galvanizers Association, October 4.

Fig. 1. Appearance of malleable and gray cast iron samples after 30-sec immersion. Note graying tendency of malleable iron specimens. X⅓

slowly (2 ft/min) in order to permit free drainage of zinc from the surface of the test specimens. All racks were handled in the same manner.

The immersion times for galvanizing were: (1) 30 seconds, (2) 60 seconds, and (3) 180 seconds. These immersion times were counted from the time the samples were totally immersed to the time of beginning removal of the rack. Since it took 15 seconds to immerse the rack and an additional 15 seconds to remove the rack, the aforementioned immersion times of 30 seconds, 60 seconds, and 180 seconds are not in strict ratio as such. These immersion times were chosen as representations of extremes in ordinary commercial practice.

The procedure for galvanizing each rack consisted of the following steps: (1) Pickle for 1 min in 6 per cent sulphuric acid at 70 F (with commercial inhibitor), (2) rinse in cold running water for 30 seconds, (3) immerse in 20 Baume zinc-ammonium chloride ($ZnCl_2$-$3NH_4Cl$) flux solution at 70 F for 15 seconds (4) allow to drain, (5) immerse in spelter at 850 F for 30, 60 and 180 seconds, (6) remove slowly, allow to drain and solidify over spelter pan (mill temperature 70 F with no wind effects).

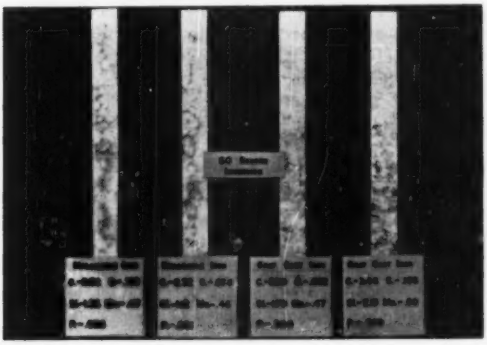

Fig. 2. Appearance of malleable and gray cast iron samples after 60-sec immersion. Note gray network on malleable specimens. X⅓.

Effect of Composition on Appearance

In this, as in previous work[1], the effect of composition had a profound effect on the appearance of slowly cooled specimens. Some samples had a bright, shiny, spangled finish, whereas others were dull gray or semi-lustrous with rough or streaked coatings. These effects are summarized in Table II.

It was readily observed that the malleable irons had a tendency to produce gray coatings, particularly at the short immersion time. The decreasing tendency of the malleable iron to produce gray coatings at the increased immersion time is because, with the heavier coatings produced, there is a greater tendency for the pure zinc layer to freeze before sufficient diffusion of iron from the base metal has caused the coating to turn gray.

No appreciable difference was found in the appearance of either of the malleable irons, which indicated that variation of silicon content within the limits indicated probably is without noticeable effect. Other elements present could be considered either essentially constant or without effect. This assumption is based on the already-known effects of these elements. It should be pointed out that the malleable iron produced at the plant from which the samples were obtained was of the low-phosphorous type. The bulk of malleable tonnage produced in this country is probably made with phosphorous contents ranging from 0.10 to 0.20 per cent. The effect of increased phosphorous content in the presence of relatively high silicon was not investigated.

Table II—Appearance of Galvanized Coating

Sample	Type	Immersion Time, sec		
		30	60	180
1	Malleable	Partly grey (45%), fairly smooth	Slight grey network, remainder semi-lustrous, fairly smooth	Trace of grey network, trace of spangle, fairly smooth
2	Malleable	Partly grey (60%), fairly smooth	Same as above	Same as above except slightly rougher
3	Gray Cast Iron	Bright, slight spangle	Bright, slight spangle slight roughness	Bright, slight spangle slight roughness
4	Gray Cast Iron	Same as above	Same as above except slightly brighter, rougher	Same as above except slightly brighter rougher
A	Steel, semi-killed	——	——	Bright, slight spangle slight roughness
B	Steel, semi-killed	Partly grey (56%), remainder semi-lustrous, smooth		Large grey area on two sides (50%), other sides semi-lustrous, slight roughness
C	Steel, semi-killed	——	——	Large grey area on one side, other side semi-lustrous, fairly rough
D	Steel, semi-killed	Small grey spot (up of one side (10%), other sides fairly bright with slight spangle	Fairly bright (no grey areas), slight spangle, slight roughness	Same as 60-sec sample
E	Steel, killed	Fairly bright, slight spangle, fairly smooth	Slight trace of grey network on three sides, faint spangle, semi-lustrous	Same as 60-sec sample
F	Steel, rimmed	Bright, spangled smooth	Bright, spangled, smooth	Bright, spangled smooth

Gray cast iron specimens exhibited identical galvanized finishes insofar as appearances were concerned. The coatings were bright, fairly smooth and with a varying degree of roughness in the form of small lumps or elevations with random distribution over the entire surface. This was in contrast to the rolled steel sections, which exhibited roughness in the form of ridges or streaks parallel to the direction of rolling. This is due to increased alloying action at these areas or points, causing them to build up and produce a roughened effect.

Fig. 3. Appearance of malleable and gray cast iron samples after 180-sec immersion. Very faint gray network on malleable specimens not discernible. X⅓.

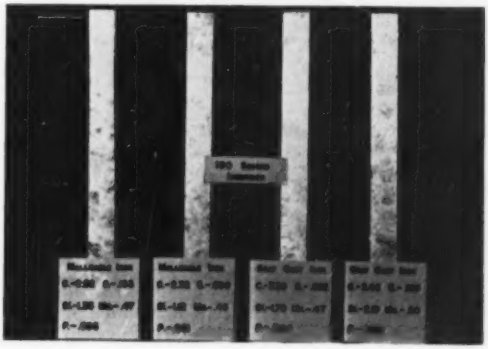

Fig. 4. Appearance of steel samples after 30-sec immersion. Note graying tendency for steels B, D. X⅓.

It would appear then that there is a noticeable difference in the galvanizing characteristics of gray iron and malleable iron as revealed by the present study. However, in actual commercial galvanizing practice, castings are quenched in water after galvanizing. This practice tends to mask inherent differences in the alloying action of these two materials.

Appearance of the galvanized steels followed already-known trends, i.e., that those steels having appreciable silicon content (over 0.060 per cent) exhibited varying tendencies toward producing gray coatings. This was generally most pronounced for the shorter immersion times.

In general, the tendency to produce a gray coating probably starts in the range of about 0.060 per cent silicon; the effect increases up to about 0.12 per cent; then decreases in the range of 0.150 to 0.250 or 0.30 per cent, beyond which range the gray tendency becomes very pronounced. Since phosphorus does not exert any noticeable effect up to 0.035 per cent, this element was of no particular significance in the samples. It is probable that streaked or built-up ridges on galvanized samples are due to banded phosphorus segregation.

Semi-killed steels will generally galvanize with a bright coating if the silicon content is low (under 0.050 per cent). In the range from 0.060 per cent to 0.10 per cent, the graying tendency becomes apparent. Of course, a bright coating can be produced for practically any type of steel by quenching the galvanized product in water. It is also obvious that section size, insofar as it affects cooling rate from the galvanizing temperature, has an important influence and thin sections will generally produce the brightest coating when air cooling from the galvanizing temperature is employed in the process.

Killed steels with relatively high silicon content tend to produce gray coatings, the exact degree of which will depend somewhat upon the silicon content and other elements, notably phosphorus.

Rimmed steels galvanize with bright, shiny, smooth spangled finishes. This is true not only of the outer rim but also of the core section. Samples used in these tests were cut from a plate so that two sides of the test specimen represented sections through the core. There was no appreciable difference in appearance, however, the core section was slightly rougher.

The appearance of malleable and gray cast irons galvanized at 30, 60 and 180 seconds are shown in Figs. 1, 2 and 3. Graying tendency for the malleable iron is quite pronounced at the 30-second immersion and much less evident at the 60-second immersion. At the three-minute immersion the very slight trace of gray network cannot be distinguished in the photograph. The gray cast iron samples did not change in appearance for the various immersion times. The appearance of the various galvanized steels is shown in Figs. 4, 5 and 6.

Effect on Coating Weight, Thickness

Coating weights were determined by the hydrochloric acid-antimony chloride method, as described by the American Society for Testing Materials. Coating thickness was obtained by micrometer caliper measurement before and after stripping. These data are summarized in Table III.

Again, it is shown that materials which tend to produce gray coatings also tend to produce the heavier coating. This fact was brought out in an earlier paper[1]. It is interesting to note that the gray cast iron produced a lighter, brighter coating than the malleable iron. The difference in coating weights was pronounced for the 3-min immersion. In the case of the semi-killed and killed steels, coating weights varied somewhat, depending upon the silicon content. Due to the miscellaneous characters of the steel samples, it is not possible to evaluate fully the effect of silicon, since the top range was limited to 0.19 per cent and it is known that the effect of silicon is not a linear function, but shows a lowering of coating weight values in the approximate range of 0.20 to 0.30 per cent. However, the steel samples did serve as a basis for comparison of malleable and gray cast iron samples.

TABLE III — EFFECT OF COMPOSITION ON COATING WEIGHT AND THICKNESS

Sample	Type	Immersion time, sec		
		30	60	180
1	Malleable	1.379* (0.0025) **	1.702 (0.0040)	3.244 (0.0058)
2	Malleable	1.150 (0.0020)	1.559 (0.0032)	3.149 (0.0056)
3	Gray Cast Iron	0.966 (0.0024)	1.032 (0.0025)	1.859 (0.0036)
4	Gray Cast Iron	0.858 (0.0020)	0.878 (0.0023)	1.415 (0.0032)
A	Steel, semi-killed	———	———	2.292 (0.0032)
B	Steel	1.323 (0.0026)	———	3.456 (0.0062)
C	Steel	———	———	2.890 (0.0052)
D	Steel, killed	1.136 (0.0015)	1.251 (0.0017)	1.571 (0.0030)
E	Steel	0.932 (0.0012)	1.250 (0.0017)	2.033 (0.0040)
F	Steel, rimmed	0.963 (0.0010)	1.118 (0.0012)	1.248 (0.0017)

* Weight of coating, oz/sq ft.
** Coating thickness in inches shown in parentheses.

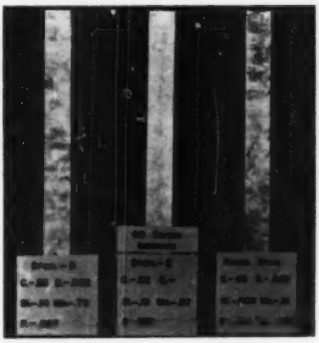

Fig. 5. Appearance of steel samples for 60-sec immersion. X⅓.

Rimmed steel specimens exhibited a tendency for light coating weight, irrespective of immersion time.

Effect of Molten Zinc Immersion

This information was compiled in the hope that such data might reveal some correlation between coating weight and appearance and might also reveal a tendency toward dross production. The results are summarized in Table IV. The relationship between weight loss and coating weight is striking. It substantiates the idea that increased alloying tendency results not only in heavier galvanized coatings, but that there is an increased tendency for a portion of the iron to dissolve in the molten spelter to eventually form dross.

TABLE IV – WEIGHT LOSS BY IMMERSION IN ZINC AT 850 F.

Sample	Type	Loss of Weight, grams/sq in.		
		30 Seconds	60 Seconds	180 Seconds
1	Malleable	7.70	14.14	—
2	Malleable	5.41	11.35	16.36
3	Gray Cast Iron	6.97	7.38	—
4	Gray Cast Iron	—	5.92	10.09
A	Steel, semi-killed	—	—	13.69
B	Steel, semi-killed	9.57	10.63	15.34
C	Steel, semi-killed	—	—	14.84
D	Steel, killed	7.89	9.88	12.15
E	Steel, killed	6.06	10.09	10.73
F	Steel, rimmed	6.85	7.37	7.79

In the case of the malleable and gray cast iron, the differences were pronounced and would lead to the general conclusion that more dross would be found in galvanizing malleable iron than gray cast iron of the types investigated. This conclusion could not be verified by actual practice, since both classes of material are galvanized in the same kettle in the particular plant where the work was performed.

In the case of the steels, the rimmed steel sample had the lowest weight loss, which was the anticipated result. The other steels revealed the same relationship between coating weight and weight loss of the sample, i.e., those steels producing the heaviest coating also had the greatest weight loss.

Summary and Conclusions

The following summarizes the difference between malleable and gray cast iron with respect to galvanized coating characteristics. These conclusions are only intended to apply to the general class of materials used, the type of test specimens employed, and the galvanizing procedure discussed in this article.

1. **Gray Cast Iron** – produced brighter galvanized coatings than the malleable iron for all the immersion times employed. The tendency for the malleable iron to produce dark gray finish was most pronounced for the 30-second immersion. The usual commercial practice of long immersion time, followed by a water quench, will always produce bright coatings on malleable iron due to arrest of alloying action.

2. **Malleable Iron**—produced the heaviest and thickest coatings, with differences most pronounced for the 3-min immersion. Coating weight for malleable was approximately twice as great as for gray cast iron for the 3-min immersion time.

3. Malleable iron revealed greater weight loss than gray iron when immersed in molten zinc. This would indicate a greater alloying tendency, which would produce heavier coatings, and a tendency to produce more dross.

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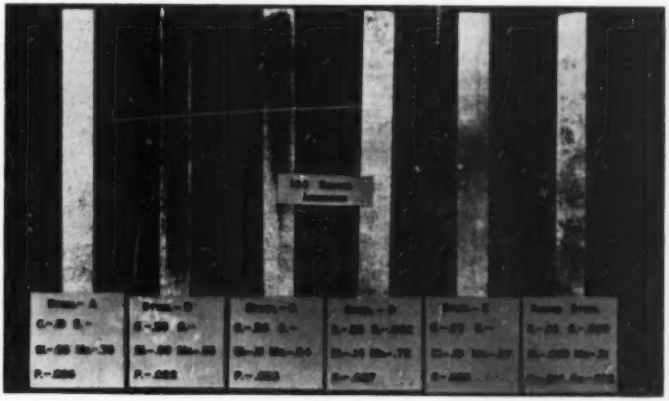

Fig. 6. Appearance of steel samples after 180-sec immersion. Graying tendency is pronounced for steels B and C. Note that rimmed steel was consistently bright, smooth and spangled. X⅓.

H. J. Chamberland

H. J. Chamberland, author of *"Continuous Filing as Applied to Castings,"* Page 37, is research engineer, DoALL Co., DesPlaines, Ill., manufacturers of bandsaws and cleaning room equipment . . . Mr. Chamberland has been engaged in the toolmaking industry for some 44 years, serving with well-known Eastern tool manufacturers . . . From 1932 to 1941, he operated his own experimental shop in Springfield, Mass., and since that time has been a consulting production engineer . . . Mr. Chamberland authored a series of 30 *"Training for War"* articles in Popular Mechanics magazine from 1943 to 1945, and is author of *Contour Saws*, 11th Edition, published by DoALL in 1944.

J. G. Rivet

J. G. Rivet, author of *"Better Sulphur Elimination in Basic Open Hearth Melting,"* Page 61, is junior metallurgist for Canadian Car & Foundry Co.'s Longue Point, Montreal, Que., Canada, plant . . . A native of Montreal, Mr. Rivet attended high school in that city, graduating first in his class and winning, successively, the Douglas Tutorship in Physics, the Province of Quebec Department of Mines Scholarship and the Douglas Tutorship in Metallurgy at McGill University . . . He assumed his present position with Canadian Car & Foundry in 1948 after receiving his B. S. Met. from McGill. He is past president of the McGill Mining and Metallurgical Society.

T. E. Barlow

Thomas E. Barlow, author of *"Core Sag Controlled,"* Page 57, is general sales manager of Eastern Clay Products, Inc., Jackson, Ohio . . . A graduate of the University of Michigan, he has been active in the foundry industry since 1935, when he joined the Ecorse Foundry Co., Detroit, as chief metallurgist . . . Following three years as research engineer for Battelle Memorial Institute, Mr. Barlow was named technical director for the Copper, Iron and Steel Development Association, Cleveland, in 1939 . . . He became foundry engineer for Vanadium Corp. of America, Detroit, from 1940 to 1944, when he returned to Battelle as research engineer . . . In 1947, Mr. Barlow assumed his present position as sales manager for Eastern Clay Products, Inc. . . . Active for many years in A.F.S. technical committee work, he has served as chairman of the A.F.S. Central Ohio chapter and is a frequent speaker before A.F.S. meetings.

C. O. Burgess

Charles O. Burgess, author of *"Gray Iron—Welding, Joining and Cutting,* Part III of which appears on Page 48 of this issue, is technical director of the Gray Iron Founders' Society and a frequent and well-known speaker before A.F.S., ASM, ASTM and other technical metals societies on production of high-duty cast irons and effects of alloys, inoculants, etc. . . . He has written many articles for the technical press and contributed monographs to the A.F.S. Cast Metals Handbook while serving as chairman of the Handbook Committee . . . Past chairman of the A.F.S. Gray Iron Division, he has served on many technical committees of A.F.S. and is past chairman of the Western New York Chapter of the Society . . . Formerly head of Union Carbide & Carbon Corp. Research Laboratories' Cast Iron and Steel departments, he has been technical director of the Gray Iron Founders' Society since 1948.

R. W. Sandelin

Robert W. Sandelin, author of *"Gray Iron, Steel and Malleable Galvanizing Characteristics,"* Page 64, is chief metallurgist for Connors Steel Co., Birmingham, Ala. . . . Holder of a B. S. (1930), M.S. (1931), Chem. Engr. (1938) and Ph. D. (1941) from the University of Minnesota, Dr. Sandelin instructed in metallurgy at Georgia Institute of Technology from 1931 to 1934, leaving there to become chief metallurgist for the Atlantic Steel Co., Atlanta, from 1934 to 1942 . . . He was commissioned a Captain, U. S. Army Ordnance, serving as technical advisor to the Birmingham Ordnance District from 1942 to 1946 . . . Upon release from active duty, Dr. Sandelin served as chief metallurgist for Stockham Valves & Fittings, Inc., Birmingham, from 1946 to 1950, when he was named to his present position as chief metallurgist for Connors Steel Co. . . . Dr. Sandelin is the recipient of the Wire Association's Medal Award (1940) and the Hot Dip Galvanizers Association's Hanlon-Gregory Award (1942).

Steel Founders Hold Annual Fall Meeting

Product development research activities were reported at the annual fall meeting of the Steel Founders' Society of America, held at The Homestead, Hot Springs, Va., with some 300 foundrymen attending.

A. J. McDonald, American Steel Foundries, principal meeting speaker, outlined the Society's broad-scale research program for improved steel foundry products.

LETTERS

Needs Metal Specimens

I should like to obtain six mounted specimens of each of the following metals for use in training students in the use of the microscope: gray cast iron, polished but unetched; gray cast iron, etched with nital; white cast iron, polished but unetched; white cast iron, etched with nital; and malleable cast iron, etched.

Arthur M. Shrager
Brooklyn Technical High School
29 Fort Greene Place
Brooklyn 1, N.Y.

Readers able to provide the specimens requested are urged to write to Mr. Shrager or to the Editor, *American Foundryman.*

Answers Request On Cast Bells

In the September issue of American Foundryman, The Round Table, page 56, we note a request for data on bell design. There is an article in the 1940-41 *Proceedings* of the Institute of British Foundrymen, page 107, by J. M. Stones describing the construction and metal analysis of cast iron bells. The article especially brings out the factors influencing sound and its relation to design.

R. Drant, *Gen. Mgr.*
Sorbo-Mat Process Engineers
St. Louis

New AFS MEMBERS

NEW COMPANY MEMBERS

Northern Cast Alloy, Inc., Van Dyke, Mich.—E. George Wanamaker, Pres. (Detroit Chapter)—Conversion from Personal.

BIRMINGHAM DISTRICT CHAPTER

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Jackson Harris House, Co-op Student—Ind. Engrg., McWane Cast Iron Pipe Co., Birmingham, Ala.
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William Walters Dodson, Engr. Trainee, Wilson Fdy. & Mach. Co., Pontiac, Mich.
Walter S. Potoczak, Fmn., Alum. Co. of America, Detroit.
W. E. Ruckstahl, Sales Engr., Refractory Sales Co., Dearborn, Mich.
William F. Spinnegan, Salesman, Monsanto Chemical Co., Detroit.
Charles R. Westfall, Harry W. Dietert Co., Detroit.
Charles O. Yoman, Sand Con. Tech., Michigan Steel Castings Co., Detroit.
Chris A. Zanison, Fdy. Supt., City Pattern Fdy. & Mach. Co., Detroit.

EASTERN CANADA CHAPTER

Alexandre Maurice Des Hayes, Engr., Dottau Products Fonderies, Montreal, Que., Canada.
J. P. Des Jardins, Coremaker, Canadian Car & Foundry Co., Longue Pointe, Que.
Robert French, Appr., Dominion Engineering Ltd., Lachine, Que., Canada.
Fred Gale, Canadian Car & Fdy. Co., Longue Pointe, Que., Canada.
William A. Laurin, Engr., Canadian Car & Foundry Co., Montreal, Que., Canada.
Howard E. Rose, Owner, Assoc. Pattern Works Reg'd., Montreal, Que., Canada.
Reginald Snutch, Ass't. Supt.—Cleaning Shop, Can. Car & Fdy. Co., Longue Pointe, Que., Canada.

EASTERN NEW YORK CHAPTER

Clifford M. Apgar, Ass't Works Mgr., Adirondack Foundries & Steel, Inc., Watervliet, N.Y.
James Wesley Burch, Appr., General Electric Co., Schenectady, N.Y.

METROPOLITAN CHAPTER

Joseph J. Bovle, Treas., Treboy Mfg. Co., Newark, N.J.
Myron A. Solin, Pres., Valley Mfg. Co., Springfield, Mass.
E. Ray Trenary, Sec., Treboy Mfg. Co., Newark, N.J.

MEXICO CITY CHAPTER

Ubaldo Alcala Ruesga, Estudiante de Quimico Metalurgista, Mexico D. F., Mexico.
Juan Pablo Velasco, Works & Maint. Engr., Industria Electrica de Mexico, S. A., Mexico D. F., Mexico.

MO-KAN CHAPTER

Clem t A. Trapp, Gen. Fdy. Fmn., Locomotive Finished Mat. Co., Atchison, Kans.

NORTHEASTERN OHIO CHAPTER

John R. Bedell, Trainee, Ferro Machine & Fdy., Inc., Cleveland.
Emil Chirila, Student, Case Inst. of Technology, Cleveland.
William H. Howells, Plant Engr., Nat. Mall. & Steel Castings Co., Cleveland.
Clarence W. Lopatta, Coremaker, Falcon Bronze Co., Youngstown, Ohio.
Walter Schaff, Jr., Jr. Engr., Falcon Bronze Co., Youngstown, Ohio.
Ralph W. Skerratt, Jr., Prod. Mgr., Falcon Bronze Co., Youngstown, Ohio.
Edward J. Vargo, Met., Wellman Bronze & Alum. Co., Cleveland.

NO. ILLINOIS & SO. WISCONSIN CHAPTER

Charles Angers, Steel Fdy. Supt., Gunite Foundries Corp., Rockford, Ill.
Alexander D. Forbes, Vice Pres., Gunite Foundries Corp., Rockford, Ill.
Duncan P. Forbes, Jr., Trainee, Gunite Foundries Corp., Rockford, Ill.
James F. McCue, Beloit Fdy. Co., Beloit, Wis.

NORTHWESTERN PENNSYLVANIA CHAPTER

S. A. Burd, Works Mgr., Lawrence Copper & Bronze, Zelienople, Pa.
Richard H. Kaulback, Met., Universal Rundle Corp., New Castle, Pa.
H. Lechtner, Mgr., Liberty Iron & Metal Co., Erie, Pa.

ONTARIO CHAPTER

Peter S. Dewar, Asst. Engr. Mech. Design, Ford Motor Co., of Canada Ltd., Windsor, Ont., Canada.
Theodore Mentis, Supt., Standard Pattern Co., Toronto, Ont., Canada.

OREGON CHAPTER

Anson B. Jackson III, Adv. Mgr., Elec. Steel Foundry Co., Portland, Ore.
Thomas A. Fee, Contractors Equip. Div., Elec. Steel Fdy. Co., Portland, Oregon.
Dar G. Johnson, Jr., Electric Steel Fdy. Co., Portland, Ore.
John P. Meece, Molder & Helper, Electric Steel Fdy. Co., Portland, Ore.
John E. Pappas, Mech. Engr., Electric Steel Foundry Co., Portland, Ore.
Elbert William Bentley, Prod. Cont., Electric Steel Foundry Co., Portland, Ore.

PHILADELPHIA CHAPTER

Albert C. Gocher, Fdy. Supt., Fletcher Works, Inc., Philadelphia.

QUAD CITY CHAPTER

Vern Frey, Mill Room Fmn., John Deere Harvester Works, East Moline, Ill.
Vern Hall, Coreroom Fmn., John Deere Harvester Works, East Moline, Ill.
Charles Kinman, Melting Fmn., John Deere Harvester Works, East Moline, Ill.
Lloyd Lopeman, Mill Room Fmn., John Deere Harvester Works, East Moline, Ill.
Joseph Stauber, Fdy. Fmn., John Deere Harvester Works, East Moline, Ill.
Thomas Stone, Fdy. Fmn., John Deere Harvester Works, East Moline, Ill.
Robert Strupp, Fdy. Fmn., John Deere Harvester Works, East Moline, Ill.
Gus Vergane, Fdy. Fmn., John Deere Harvester Works, East Moline, Ill.

FEF Awards Scholarships to 24 Wisconsin Foundry Students

Awarded Foundry Educational Foundation scholarships at the University of Wisconsin this year was this group of engineering students, which includes three freshmen, one sophomore, nine juniors and 11 seniors. All of these young men have spent at least one summer working in the foundry, while 50 per cent of them have had two or three summers' foundry experience. The group meets bi-weekly to hear talks by prominent Wisconsin foundrymen, arranged through cooperation with the A.F.S. Wisconsin Chapter, on the many phases of the metal castings industry.

SAGINAW VALLEY CHAPTER

Bruce J. Allen, Fdy. Fmn., Buick Motor Div., G.M.C., Flint, Mich.
Joseph C. Bourcier, Supv., Central Fdy. Div., G.M.C., Saginaw, Mich.
Oswald Braun, Patt. Supt., Central Fdy. Div., G.M.C., Saginaw, Mich.
Franklin French, Supv., Central Fdy. Div., G.M.C., Saginaw, Mich.
Wilmer W. Hohnke, Fdy. Dev. Engr., Dow Chemical Co., Bay City Div., Bay City, Mich.
John A. McKinnon, Purch. Agent, Bay City Electric Steel Castings Co., Bay City, Mich.

ST. LOUIS DISTRICT CHAPTER

Everett W. Springer, Asst. Plant Engr., U.S. Radiator Corp., Edwardsville, Ill.
Roy Van Scoyoc, Chief Insp., Century Fdy., Div. of Cent. Elec., St. Louis.

SOUTHERN CALIFORNIA CHAPTER

L. W. Dykes, Supt., Gregg Iron Fdy., El Monte, Calif.
H. W. Larson, Vice-Pres., Gregg Iron Fdy., El Monte, Calif.
J. R. Ludwig, Pouring Fmn., Gregg Iron Fdy., El Monte, Calif.

TENNESSEE CHAPTER

W. R. Daniell, Sales Mgr., Dawes Silica Mining Co., Thomasville, Ga.
S. M. Newsom, Salesman, Carborundum Co., Chattanooga, Tenn.

TEXAS CHAPTER

J. D. Browder, Sales Mgr., Western Fdy. Co., Tyler, Tex.
O. O. Pope, Supt., Western Fdy. Co., Tyler, Tex.
Hal Terry, Purch. Agent, Western Fdy. Co., Tyler, Tex.
Hugh C. Walter, Sec.-Treas., Western Fdy. Co., Tyler, Tex.
Charles J. Yaeger, Dist. Sales Mgr., A. P. Green Fire Brick Co., Houston, Texas.

TIMBERLINE CHAPTER

Robert Danson Forest, Student, Colorado School of Mines, Denver, Colo.

TRI-STATE CHAPTER

Charles F. Knuepfer, Fmn., Service Foundry, Wichita, Kansas.

TWIN CITY CHAPTER

Ernest S. Reiland, Patternmaker, General Pattern Co., St. Paul, Minn.
George S. Finneman, Asst. Gen. Supt., National Iron Co., Duluth, Minn.
Geo. W. Nelson, Fdy. Supt., Central Machine Works Co., Minneapolis, Minnesota.

WESTERN MICHIGAN CHAPTER

Erwin H. Albrecht, Fdy. Supt., Blackmer Pump Co., Grand Rapids, Mich.
Everett J. Duval, Sand Lab. Tech., Campbell, Wyant & Cannon Fdy. Co., Muskegon, Mich.
Earl C. Jensen, Proc. Manager, West Mich. Steel Fdy., Muskegon, Mich.
E. F. Martin, Supt., Grand Rapids Foundry, N.W. Grand Rapids, Mich.
Layton K. Winsemius, Fdy. Supt., Moore Plow & Equip. Co., Greenville, Michigan.

WESTERN NEW YORK CHAPTER

Walter Gorney, Fdy. Millwright, Worthington Pump & Mach. Co., Buffalo, N.Y.
S. Santomieri, Fdy. Fmn., Worthington Pump & Mach. Co., Buffalo, N.Y.

WISCONSIN CHAPTER

Eugene Adamczyk, Student, University of Wisconsin, Madison, Wis.
Melvin E. Molitor, Trainee, Grede Foundries, Inc., Milwaukee.
Fred Wolff, Patt. Engr., Delta Mfg. Co., Milwaukee.
Armand W. Wolter, Fmn., Grede Foundries, Inc., Milwaukee.

STUDENT CHAPTERS

M.I.T.

W. James Erdmann, Eugene A. Leary, Robert J. Murphy
Leonard Nanis, James K. Sprinkle

MICHIGAN STATE COLLEGE

Russell E. Brant, Louis M. Bachinski, Clarence D. Bertin
Ralph G. Boyll, Jr., Ellard D. Davison, Jr., Duane E. Dent
Richard H. Dobbins, Gerald A. Gobb, Richard T. Jeffreys
Jerome K. Lampe, Charles W. Philp, Emil Ravlin
John F. Richards, Burt Romick, Ashley B. Sinnett

MISSOURI SCHOOL OF MINES

William D. Bradley, Lyle E. Cantwell, George L. Gimbrone
George Kermit Grace, Bevzn William Luther, Alfred Neiman

OHIO STATE UNIVERSITY

Thomas Cunningham, William M. Harper, Edward T. Young

UNIVERSITY OF ALABAMA

Arnold Abrams, Charles A. Beeds, Robert L. Bronnes
Theodore B. Brydges, John H. Goodman, Roland L. Le Vaughn
James McNeal Morgan, George Pallas, Richard E. Ray

UNIVERSITY OF ILLINOIS

Robert C. Anderson, Roger M. Baker, Billy S. Campbell
Sheldon H. Horn, Otto Wolfgang Junkel, Robert Necheles
Philip M. Mueller, William T. Purcell, Jack Raymer
John M. St. John, Eugene John Schwetz, M. Robert Schroeder
Kenneth D. Shimmin, Harold Sinder, Lawrence B. Zylstra

UNIVERSITY OF MINNESOTA

John S. Tiedemann

INTERNATIONAL

Australia

Roy William Cox, Mgr., Grimwade Castings Fdy. Ltd., Port Melbourne, Victoria, Australia.

Chile

Raoul Meunier Castelain, Fdy. Tech. Engr., Fabrica Cemento "El Melon", Le Calera, Chile.

Japan

Choichi Saito, Prod. Mgr., Toyota Motor Co., Koromo, Near Nagoya, Japan.

Norway

H. S. D. Cappelen, Pres. & Owner, S. D. Cappelen, Ulefos Jernvaerk, Ulefoss, Norway.

CHAPTER ACTIVITIES NEWS

Mo-Kan

Thomas F. Shadwick
Witte Engine Works
Chapter Reporter

EVENING SAND SCHOOL was the main event of the October 11 meeting, held in the Fairfax Municipal Airport building. Presiding at the Sand School, Frank S. Brewster, Harry W. Dietert Co., Detroit, showed how sand testing is applicable to foundries of almost any size, outlined methods of control and described equipment needed.

Mr. Brewster pointed out the need for knowledge of different types of sands on the part of the foundryman in order to aid in selection of the right sands for specific types of castings. He recommended that, where possible, one man should have charge of sand testing for both the foundry and coreroom, and further recommended that a record be made of each test and the results checked against castings for which the sand was used.

Mr. Brewster then showed slides picturing the different types of casting defects traceable to improper sand. He also showed graphs and charts illustrating effects of moisture and gas on sand.

Entertainment Chairman Edwin Brumley, Brumley-Donaldson Co., and Co-Chairman Clayton Russell, Phoenix Iron Works, tote up golf scores at the 16th Annual Golf Party of Northern California Chapter, held at Sequoyah Country Club, Sept. 29. (Northern California Chapter photographs courtesy of A. F. S. Past National Director Sam Russell, Phoenix Iron Works.)

Sand permeability, flowability, sintering point, fusion point, green strength and hot strength were discussed in detail by the speaker.

Chapter Chairman Leslie Neville, Neville Foundry Co., North Kansas City, Mo., welcomed visitors to the meeting. It was voted by the members to launch a membership campaign, and to have a Christmas Party in place of the December technical meeting.

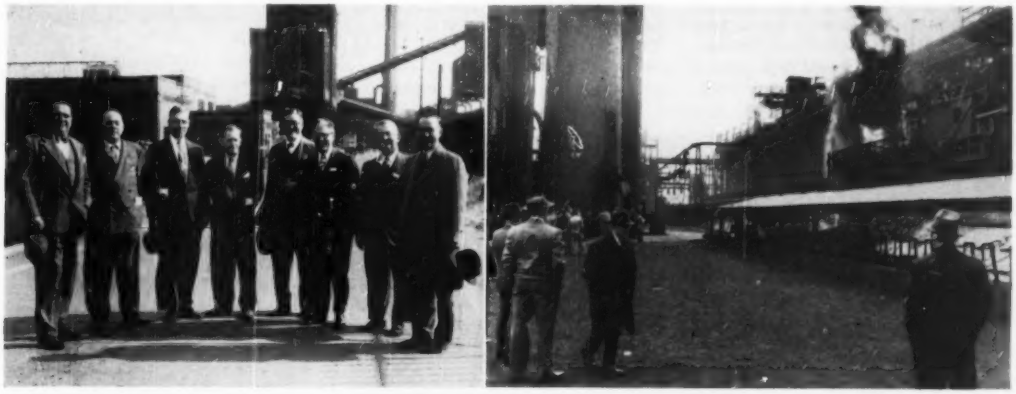
Philadelphia

G. H. Bradshaw
Philadelphia Naval Shipyard
Chapter Vice-Chairman

A. J. Saute
American Engineering Co.
Publicity Chairman

OPENING the chapter's 1950-51 activities was a two-day educational course on "Cupola Operation," held at the University of Pennsylvania's Engineering Building and attended by 66 management men, technical production personnel, mechanics in supervisory training and apprentice molders coming from a radius of 300 miles.

Lecturer for the course was B. P. Mulcahy, Fuel Research Laboratory, Inc., Indianapolis. Mr. Mulcahy broke



Photographed during a visit of the Philadelphia Chapter to the plant of the Philadelphia Coke Co. on October 13 were (left photograph), left to right: Past National Director John M. Robb, Jr.; Chapter Vice-Chairman G. H. Bradshaw, Chapter Chairman Clyde Jenni, Meeting Speaker B. P. Mulcahy, Fuel Research Laboratories, Inc., Indianapolis; Herman Mandel, Chapter Educational Chairman; and Philadelphia Coke Co. President W. B. Ross, Manufacturing Superintendent F. D. Miller and Industrial Engineer Donald McBrien. (right) Watching oven of hot coke being pushed into quenching car at end of coking cycle.

the course down into sessions, used slides and entered into discussion of questions. His approach to this subject was such that anyone connected with the foundry industry could readily follow him and was delivered in an intelligent and practical manner.

Following the educational course, the first meeting of the 1950-'51 season was held October 13. A visitation to the Philadelphia Coke Company was held in the afternoon. Following a luncheon at the Philadelphia Coke plant, a complete plant inspection was made by individual groups.

Dinner was held at the Engineers' Club, where the Technical Chairman, B. A. Miller, Baldwin Locomotive Works, introduced the speaker of the evening, Mr. Mulcahy, who discussed five variables and fundamentals of cupola operation and use. Each subject was discussed individually and was well illustrated by slides. A long question and answer discussion followed the speech, which was enjoyed by everyone.

St. Louis District

N. L. Peukert
Carondelet Foundry Co.
Chapter Reporter

OCTOBER 12 MEETING, held at the York Hotel, St. Louis, opened with a report by Educational Chairman A. L. Hunt, National Bearing Div., American Brake Shoe Co. on activities at the Missouri School of Mines. The school, Mr. Hunt reported, is progressing rapidly in the installation of foundry equipment and is expanding its foundry course. A complete floor of an existing building is being made available for the foundry, Mr. Hunt said, adding that the St. Louis District Chapter has been given a great deal of credit for this progress by school personnel, including Dean Curtis Wilson.

Mr. Hunt also reported presentation to the A.F.S. Student Chapter of a complete set of A.F.S. publications donated by the St. Louis Chapter. Dean Wilson of the school, as a token of gratitude to the members of the St. Louis Chapter who have taken an active part in the foundry program, extended an invitation to the school homecoming football game, held in Rolla October 28.

The meeting's timely topic was *"The Foundry's Place in the Military Defense Program"*, with Loren Jenks, Chief of the Central Planning Section Ordnance Tank Automotive Center, Detroit, as speaker.

Mr. Jenks said that in World War II the country had a great shortage of armor plate manufacturing facilities. This was solved by building several large foundries and by converting existing plants, he said. The speaker explained the setup of ordnance districts. The overall plan, he said, is to make each district self-sufficient with regard to prime contractors and sub-contractors.

Reporting on the presentation of a complete set of A.F.S. publications by the St. Louis District Chapter to the Missouri School of Mines is (standing) Albert L. Hunt, National Bearing Div., American Brake Shoe Co. Seated at speakers' table at the Chapter's October 12 meeting are, left to right: Lieut. Colonel Childs, Chief of Ordnance, St. Louis District; Chapter Chairman John Williamson, M. A. Bell Co., and A.F.S. National Director Lloyd C. Farquhar, Sr., of American Steel Foundries.

Speaker Robert Hendry, Love Bros., Inc., Aurora, Ill., emphasizes cooperation between jobbing foundries and pattern shops at the Gray Iron and Pattern Round Table, a feature of the Chicago Chapter November meeting.

Central Michigan

J. T. Ehman
Albion Malleable Iron Co.
Publicity Chairman

SIXTY-SIX MEMBERS and their guests met at the Hart Hotel, Battle Creek, to hear Paul Moore of Michigan State College's Department of Continuing Education speak on *"Participation Increases Production."* Lachlin Currie, technical director for the evening, introduced the speaker.

Mr. Moore said he believes that current production in industry is low and that only approximately 30 per cent of the potential output is being produced. Even with wage incentive plans in operation, industrial workers tend to produce at a rate considerably below their potential. Only by improvements in the field of human relations can this obstacle be overcome, Mr. Moore said.

The speaker continued with a history of industrial human relations, which he divided into three eras. The first, which was characteristic of industry 25 to 50 years ago, was one in which force was the predominate aspect, with little emphasis being placed upon human relations. The second era, in which most industrial concerns find themselves today, he said, is one in which an honest effort is being made to achieve good employer-employee relationships.

Era number three, which we are now approaching, will be characterized more and more by participation plans, Mr. Moore believes. He is a particular advocate of the Scanlon Plan, which is not a profit-sharing, but a production sharing plan. Regardless of profits, a certain percentage of the cost of production is allocated to the workers and is then divided among them according to rates. In conclu ·on, Mr. Moore gave

several suggestions for improving human relations in industry.

The meeting ended with a showing of the Michigan-Michigan State football film, narrated by Starr Kiesler, Director of Alumni Relations, Michigan State College.

Chicago

Dean Van Order
Burnside Steel Foundry Co.
Chapter Reporter

Almost 200 foundrymen attended the November 6 meeting and prior to round-table discussions saw a short film taken at the recent Chapter outing. This first round-table meeting of the season was more than successful, and one of the discussion groups—the malleable division—had the largest round-table attendance in its history. Discussions of each of the four groups—gray iron and pattern, steel, non-ferrous, and malleable—featured current problems in their particular fields.

Discussion subjects included *"Cooperation between Jobbing Foundry and Pattern Shop"; "Non-Ferrous Foundry Practice"; "Development of Steel Composition and Physical Properties"; and "Malleable Metal, Melting, and Annealing."* Judging by the group attention and participation, the subjects were well selected and discussed.

Canton District

Alexander Prentice
Stark Foundry Co.
Chapter Reporter

SEVENTY-FIVE MEMBERS and guests attended the October 5 meeting, held at Mergus' Restaurant, Canton. Presiding was Chapter Chairman Thomas W. Harvey, Pitcairn Co., Barberton, with Vice-Chairman C. B. Williams, Massillon Steel Castings Co., introducing Speaker B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., whose topic was *"Causes of Hot Tears and Strain Cracks."*

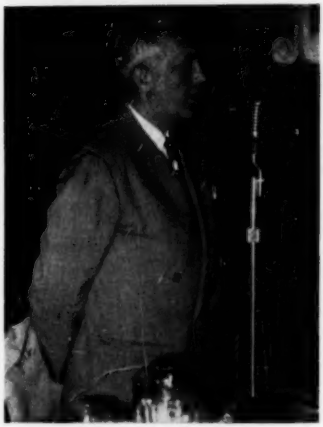
In describing practical applications

MSM Student Chapter Member George Wagner adjusts burner on crucible furnace during foundry open house, held in conjunction with Missouri School of Mines Parents' Day ceremonies. (Photo: N. F. Neumann).

Canton District Chapter notables surround Speaker B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., at the Chapter's October 5 meeting. From left: Past Chairman Gordon E. Robertson, Stark Foundry Co.; Vice-Chairman C. B. Williams, Massillon Steel Castings Co.; Mr. Yearley; and Chapter Chairman Thomas W. Harvey of the Pitcairn Co.

"Clinic for Foundry Headaches" was the title of the Malleable Round Table session at Chicago Chapter's November meeting. Discussing metallurgical, melting and annealing problems were, left to right at speakers' table: Theodore Czima, National Malleable & Steel Castings Co., Cicero, Ill.; H. W. Maack of Crane Co., Chicago; Frank Chapski, Chicago Malleable; C. F. Semrau, Illinois Malleable Iron Co.; E. A. Radke, International Harvester Co.; and William Moran of the William E. Pratt Manufacturing Company.

that have proved scientific theories on the subject, Mr. Yearley explained contraction and expansion of molding and core sands and their relationship to hot tears. Often, he pointed out, improper gating and heading can cause difficulties because of differences in expansion and contraction, especially when there are thick and thin sections in a casting. Mr. Yearley illustrated this by using a sprocket with thin spokes and a heavy hub as an example and explained that much trouble was encountered when the casting was gated into the hub, but that after gating on the thin spokes, the trouble was overcome.



Loren Jenks, Chief, Central Planning Section, Ordnance Tank Automotive Section, Detroit, speaking on "The Foundry's Place in the Military Defense Program" at the St. Louis District Chapter's October 12 meeting, York Hotel, St. Louis.

Missouri School of Mines

Norbert F. Neumann
Chapter Reporter and Photographer

SECOND MEETING of the year, held October 4, featured a talk by Student Chapter Industrial Advisor George E. Mellow, Liberty Foundry Co., St. Louis, on economics of foundry operation.

Mr. Mellow gave an instructive and comprehensive report on the cost of manufacturing a casting, including the cost of melting, molding, coremaking, cleaning and shipping.

A large group of members of the A.F.S. St. Louis District Chapter attended the meeting, including Chapter Chairman John Williamson, M. A. Bell Co.; W. C. Pickles, Joseph McVey, Steve Ban and H. Weber of American Brake Shoe Co.; J. R. Bodine, Bodine Pattern & Foundry Co.; and R. E. Woods, M. W. Warren Coke Co.

FUTURE CHAPTER MEETINGS

● DECEMBER 19

EASTERN NEW YORK
Circle Inn, Lathams
CHRISTMAS PARTY

● JANUARY 8

WESTERN MICHIGAN
Cottage Inn, Muskegon
CLYDE A. SANDERS
American Colloid Co.
"Effect of Mold Materials on Metal Shrinkage"

CINCINNATI DISTRICT
Engineering Society, Cincinnati
A. J. GRINDLE
Whiting Corp.
"Smoke, Fume and Dust Prevention"

CENTRAL ILLINOIS
Legion Hall, Peoria
W. W. LEVI
Lynchburg Foundry Co.
"Cupola Operation"

METROPOLITAN
Essex House, Newark, N. J.
HAROLD J. ULLRICH
Sacks-Barlow Foundries, Inc.
"Ductile Iron"

CHICAGO
Chicago Bar Association
ROUND TABLE MEETINGS

JANUARY 8 (cont'd)

MICHIANA
Alby's Steak House, South Bend, Ind.
W. R. JALACHKE
Whiting Corp.
"Heat Treatment"

● JANUARY 9

TWIN CITY
J. A. GITZEN
Delta Oil Products Co.
"Core Sand Additives"

N. ILLINOIS-S. WISCONSIN
Faust Hotel, Rockford, Ill.
S. C. MASSARI
A.F.S. Technical Director
Film: *"Fluid Flow in Transparent Molds II"*

● JANUARY 11

ST. LOUIS DISTRICT
York Hotel, St. Louis
CHARLES K. DONOHO
American Cast Iron Pipe Co.
"Nodular Iron"

● JANUARY 12

NORTHWESTERN PENNSYLVANIA
Siebingburger Singing Club, Erie
CHRISTMAS PARTY

Western New York

Marve Taublieb
Frederic B. Stevens, Inc.
Public Relations Officer

NOVEMBER MEETING was held in the Hotel Sheraton, Buffalo, November 3, with Donald L. Hayes, Laverack & Haines, Inc., Buffalo, speaking on *"The Effect of the Workmen's Compensation Law on Accident Prevention."*

Mr. Hayes first presented a history of the safety movement, going back to 1910, when most benefits to employees were voluntary on the part of the employer. Prior to this, he pointed out, accident cases proved a field day for the law profession. The present New York State Law was passed in 1914, and the real advance in safety began. He mentioned the safety program as humanely reducing pain and suffering and the indirect loss phase, which involves excitement and work stoppage at the time of accident.

Rewards or fines to the employer through his insurance carrier should make him safety conscious. The point Mr. Hayes emphasized was that of hiring and assigning men in line with their mental capacities, and giving necessary instructions for the job. He also mentioned the importance of the safety engineer in the plant.

Mr. Hayes spoke of the many occupational diseases that are now compensable under the laws of New York State which were previously considered diseases of old age or of natural causes. In conclusion, he pointed out that a safety program is necessary because the courts have become so liberal that insurance costs are certain to mount unless the program is enforced.

Edward Roesch, of the American Brake Shoe Co. then presented the safety history and program of American Brake Shoe Co.

Mr. Hayes was introduced by Albert A. Diebold, of the Atlas Steel Casting Co., chapter chairman. Technical Chairman for the meeting was Reinhold D. Loesch, Lake Erie Foundry Co.

Detroit

R. Grant Whitehead
Claude B. Schenible Co.
Chapter Reporter

OCTOBER MEETING, "Father and Son Night," was held at the University of Michigan, Ann Arbor, where members toured the University's several engineering laboratories.

In the foundry, students were at work making molds under careful supervision and after pouring, the visiting members were able to examine the

FUTURE CHAPTER MEETINGS

JANUARY 12 (cont'd)

PHILADELPHIA
Engineers Club, Philadelphia
BERNARD N. AMES
New York Naval Shipyard
"Brass and Bronze—(a) C-Process for Making Molds and Cores; (b) Melting of Tin Bronzes"

EASTERN CANADA
Mount Royal Hotel, Montreal
MICHAEL BOCK, II
Exomet, Inc.
"Insulation in Promoting Feeding"

TRI-STATE
Tulsa, Oklahoma
VAUGHAN C. REID
City Pattern Foundry & Machine Co.
"Materials Used in the Construction of Production Pattern Equipment"

● ***JANUARY 13***

CHESAPEAKE
The Alcazar, Baltimore
FOURTH ANNUAL OYSTER ROAST

● ***JANUARY 15***

QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
RAY A. WITSCHEY
A. P. Green Fire Brick Co.
"Foundry Refractories"

● ***JANUARY 16***

EASTERN NEW YORK
Circle Inn, Lathams
Film: *"Fluid Flow in Transparent Molds II"*

● ***JANUARY 17***

CENTRAL MICHIGAN
Legion Clubhouse, Battle Creek
KENNETH ROBINSON
Michigan Department of Health
"Dust Control"

● ***JANUARY 18***

DETROIT
Leland Hotel, Detroit
"Quality Control by Statistical Methods"

● ***JANUARY 19***

BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham
R. A. FLINN
American Brake Shoe Co.
"Soundness and Feeding of Ductile and Gray Iron Castings"

TEXAS
Ft. Worth
Film and Panel Discussion: *"Men and Molds"*

efforts of their labor. The tour later took in the Heat Treating Department, Machine Shops and Tool Room. All visitors were reassembled and then taken to the Physics Laboratory, where we saw the cyclotron and synchroton. After this a planned tour conducted us to the Michigan Union Building where we had dinner and the evening meeting.

The first item on the agenda was the presentation of the "gavel of authority" by Outgoing Chairman Ray Wilcox to Incoming Chairman Jess Toth. This Gavel, incidentally, is cast from gray iron, steel, malleable iron, magnesium, aluminum and bronze.

Chairman Jess Toth then presented Mr. Wilcox with a Chapter gift in appreciation of the splendid work done during his term of office.

The Chairman then introduced guests and speakers. Dr. Frank Roth, Head of the Foundry Department, University of Michigan, spoke on the training and the education afforded engineering students. Professor Boston, head of the Metals Processing Division, told of the importance of foundry training and associated courses offered engineering students.

Instructor Emeritus John Grennan talked on *"Melting in the Cupola"* and showed a color movie taken through ports in the cupola shell at the university foundry. This interesting film added to our knowledge as to what actually goes on inside the cupola. Vice-Chairman Vaughn C. Reid presented Mr. Grennan with a set of Detroit Chapter book ends.

Central Pennsylvania

R. W. Lindsay
Pennsylvania State College
Reporter

SECOND MEETING of the season was held November 1 in the Art Gallery of the Pennsylvania State College School of Mineral Industries.

A.F.S. National Director Thomas E. Eagan, Cooper Bessemer Corp., Grove City, Pa., spoke on the *"Practical Aspects of Nodular Iron,"* in which he presented two sides of the subject.

Mr. Eagan first discussed such matters of interest to foundrymen as desired compositions, structural control, treatment materials and foundry characteristics.

The second part of his talk dealt with certain facts that interest engineers and designers in connection with this group of materials. Mr. Eagan emphasized that the structural durability of the component part is a matter of prime concern. Slides were shown of various parts and pieces of equipment and Mr. Eagan discussed the pros and cons for nodular iron in these applications. A lively discussion followed the talk.

Eastern Canada

A. E. Cartwright
Crane Co., Ltd.
Chapter Reporter

GOOD TURNOUT of members and guests heard an informative talk by Etienne Spire, Canadian Liquid Air Co., Ltd., Montreal, at the October 13 meeting, on *"Usefulness and Ill Effects of Gases in Metallurgy."*

Ill effects of hydrogen in ferrous and non-ferrous metals were fully indicated by photographs and graphical data while correction of these effects by flushing of molten alloys with nitrogen, in the case of non-ferrous alloys, and argon for ferrous alloys was well described by the speaker.

Dr. Spire also referred to a recently developed and patented gas flushing ladle, a result of the combined research of Canadian Liquid Air Co., Ltd., the Physical Metallurgy Laboratories of the Canadian Bureau of Mines, and Canadian Refractories Ltd. The patent discloses several designs of a porous refractory insert plug set in the refractory bottom of a ladle having a pressure chamber below with pipe connections for introducing nitrogen or argon. The inert gas so introduced

Photographed on the office steps of Electric Steel Foundry Co., Portland, Ore., were (left) James T. Brodigan, Oregon Chapter Chairman, and A.F.S. National Secretary Treasurer Wm. W. Maloney, who recently returned from an extensive tour of West Coast Chapters.

Attending the September 14 meeting of the Northeastern Ohio Chapter to hear Speaker Clyde A. Sanders (seated, right foreground), American Colloid Co., Chicago, on sand and molding practices was this attentive group of foundrymen. (Photo: Sterling N. Farmer, Sand Products Corp.)

through the porous plug flows in fine dispersion through the molten metal, giving a thorough mechanical removal of hydrogen in much shorter period and with less temperature loss than could be obtained previously by bubbling the gas through the metal, using a refractory tube inserted down into the metal, the speaker concluded.

Northeastern Ohio

R. H. Herrmann and Pat Dwyer
Penton Publishing Co.
Chapter Reporters

JOINT MEETING of the foundry and patternmaking division filled the ball room of the Tudor Arms Hotel, Cleveland, to capacity at the October 12 meeting, presided over by Fred J. Pfarr, Lake City Malleable Co., of Cleveland.

Following a brief routine session, including introductions and typical announcement by L. P. Robinson, Werner G. Smith Foundry Sales Division, Archer-Daniels-Midland Co., of several features in connection with the proposed Christmas party December 14 at Hotel Carter, Cleveland, the audience listened with marked appreciation to three speakers. Jimmy Lee, athletic director, Cleveland Athletic Club, presented an interesting and at times humorous running commentary on the 1948 Olympic Games which he attended in London.

During the second feature on the program the audience sat in darkness for 45 minutes while George Zang and E. F. Chittenden, Unitcast Corp., Toledo, O., presented a *"Let's Pretend"* safety training program. Blindfolded in the dark room, the audience lit cigarettes, sprinkled tooth powder on a brush, felt pieces of cloth, tried to read Braille, and in a general way learned what they would have to do and what to avoid in the event eyesight was lost. The entire presentation was built around the speaker's belief that spasmodic or intermittent efforts to inculcate safety into the minds of people is wasted effort.

Every person carelessly or confidently believes that the accident, light or heavy, might happen to the other fellow, but that he is immune. Since the greater part of the address was centered on accidents in the industrial field, the speaker claimed that those in charge of plants constantly should preach and practice safety. Through the natural perversity of human nature, workmen refuse to be driven along any designated path. On the other hand, they may be led under wise and skilful direction.

Central Illinois

Robert J. Paluska
Caterpillar Tractor Co.
Chapter Reporter

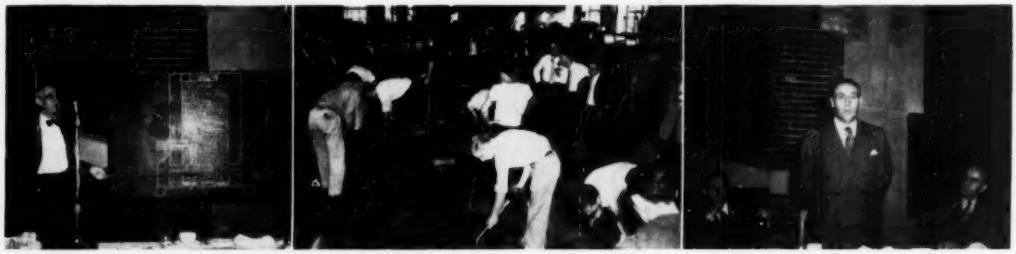
SPEAKER at the November dinner meeting was Russell J. Anderson, Belle City Malleable Iron Co., Racine, Wis., who spoke on *"Keeping the Foundry Up To Date."*

In his talk, Mr. Anderson stated that although the foundry is one of the oldest industries it has been slowest to advance, but if it continues to improve as it has in recent years it will soon become one of the most advanced industries. He also added that the art of making castings dates back as far as 4000 B. C., and at present over a million tons of castings are made each month. In addition to his talk, Mr. Anderson showed a number of slides on production improvements incorporated at Belle City Malleable.

Central New York

James W. Ogden
Cleveland Tramrail Syracuse Co.
Publicity Chairman

OCTOBER MEETING, held in the Onondaga Hotel, Syracuse, opened with a business meeting, at which Chairman David Dudgeon, Jr., Utica Radiator Corp., announced that the Chapter is contributing to the A.F.S. Building Fund and urged those present to make



Featured at the October meeting of the Detroit Chapter, held on the Engineering Campus of the University of Michigan, were talks by faculty members and a tour of the University's laboratory facilities and shops. (Left) Michigan Instructor Emeritus John Grennan addresses visiting foundrymen on "Melting in the Cupola". (Center) Students at work in the University's foundry. (Right) Professor Boston, head of the University of Michigan's Metals Processing Division describes school's foundry educational aims.

Attending Central Michigan Chapter's opening meeting of the 1950-51 season were, left to right: Incoming Chapter Vice-Chairman David Sherman, Incoming Secretary-Treasurer Thomas Lloyd; Guest Speaker James T. MacKenzie. American Cast Iron Pipe Co., Birmingham, Ala.; Director Richard Moore, Incoming Chairman Jack Secor and Retiring Chairman Fitz Coghlin.

individual contributions to this worthy project.

Speaker of the evening R. E. Savage, International Nickel Co., discussed *"Recent Developments in Ductile Iron,"* in which he said there are now more than 300 foundries producing this comparatively new material. Production, he said, has increased from 3500 tons in 1949 to 20,000 tons in 1950.

Some of the important features of this new metal covered by Dr. Savage were: it can be cast in thinner sections because of its strength; it is easily welded and can stand a good deal of shock. With ductile iron, machining time can be cut about 33 per cent over most other irons and it is also easier on cutting tools.

Ductile iron has, according to the speaker, given the foundry industry a material to compete with weldments, forgings and some steel castings and, presented to American industry as a whole, a new engineering material which will help meet material shortages and increased requirements.

Metropolitan

John Bing
Metropolitan Refractories Corp.
Chapter Reporter

OCTOBER 2 MEETING featured a talk by Bernard N. Ames, New York Naval Shipyard, on *"Shell Molding Techniques."* Mr. Ames' discussion covered the process as developed by New York Naval Shipyard's Material Laboratory and stressed setting times and temperature, curing time and temperature and resin sand formulae.

The speaker described equipment used in the Laboratory's pilot plant in detail and reviewed applications of this process to various alloys. Concluding his talk, Mr. Ames discussed influence of the process on metallurgy of nonferrous alloys. Mr. Ames supplemented his talk with slides and with an exhibit of shell molds, cores and castings.

November 6 meeting featured a Foundry Clinic, with J. S. Vanick, International Nickel Co. as moderator, and E. C. Troy, foundry consultant, Palmyra, N. J.; H. H. Kessler, Sorbo-Mat Process Engineers; R. R. Walten, New York Naval Shipyard; and Mr. Simpson of Eclipse Pioneer Div., Bendix Aviation Corp. as discussion leaders.

Discussed by the Clinic were: use of inhibitors with #220 aluminum alloy in green sand; effects of cerium on aluminum, chlorine on metal and sulphur dioxide on molds for aluminum and magnesium; degassing and effects of aluminum, oxides, antimony, etc. on bronzes; core gas vs. leaded and other bronzes; effects of tellurium, aluminum and cadmium on gray iron; qualitative effects of inoculants vs. shrinkage in cast iron and aluminum.

Other topics discussed were: cupola —bed burn-through, coke sizes, extra coke splits, refractories; pitting in precision castings of stainless steel; iron oxide in core mixes; wood fire vs. oil torch-heated ladles; and use of seacoal.

The meeting was very successful and proved to be the type of meeting that the majority of chapter members really want and make every effort to attend.

Tennessee

Carl A. Fischer, Jr.
Fischer Supply Co.
Chapter Reporter

REGULAR DINNER meeting of the Chapter was held September 22 in the Hotel Patten, Chattanooga.

Approximately 60 members and guests were present to hear the speaker of the evening, Charles K. Donoho, American Cast Iron Pipe Co., Birmingham, Alabama, on *"Nodular Iron."*

Mr. Donoho showed many slides on the projector showing the results of the many experiments his company had made on nodular iron. Mr. Donoho says that the matter of nodular iron is not yet settled and there is quite a bit of disagreement as to its merits and properties at this time. Chairman, Paul Arnold, U. S. Pipe & Foundry Co., presided and the program was in charge of Vice Chairman Porter Warner Jr., Porter Warner Industries, Inc.

Central Michigan

Frank P. Tobakos
Albion Malleable Iron Co.
Publicity Chairman

OPENING MEETING of the season was attended by more than 100 members and guests, who heard Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., speak on *"Gray Iron Foundry and Melting Practice."*

With the aid of slides, Dr. MacKenzie explained some of the research work that has been done by his company on cupola operations. Among the things covered was the affect on operations due to varying the blast pressure; the type and size of coke, the chemical composition of the coke, and type scrap.

(Continued on Page 93)

Enjoying themselves at Tennessee Chapter's September 22 meeting were, left to right; Frank Hoffman and Howard Wilson, Somerville Iron Works, Ed Williams, Ingersoll-Rand Co., T. A. Johnson, Somerville Iron Works.

FOUNDRY Personalities

John Hellstrom, vice-president of American Air Filter Co., Louisville, has been named manager of AAF's newly-created Pacific Division, San Francisco. Mr. Hellstrom will supervise Western activities of both American Air Filter and its Herman Nelson Division of Moline, Ill., in California, Oregon, Washington, Idaho, Montana, Utah, Arizona, New Mexico and western Texas. He is a director and immediate past president of the Foundry Equipment Manufacturers' Association. Mr. Hellstrom will be assisted on the Pacific Coast by **Robert H. Walpole, Jr.,** who for the last four years has been engineering supervisor of the company's Dust and Fume Control Division, San Carlos, Calif. It was also announced that **J. M. Kane,** formerly chief engineer of the Dust Control Div., has been appointed Division manager. He will be succeeded by **J. G. Liskow.**

John Hellstrom

Donald H. Workman has been named acting executive vice-president of Gray Iron Founders' Society, Cleveland, following the recent resignation of **Raymond L. Collier,** according to an announcement by GIFS President E. L. Roth, Motor Castings Co., West Allis, Wis.

Melvin O. Sten, chief engineer for Hunt-Spiller Mfg. Corp., Boston, recently completed 25 years of service with the company. A graduate of Northwestern University, Mr. Sten joined Hunt-Spiller as a draftsman in 1925.

Recent executive changes in personnel of Canadian Car & Foundry Co., Ltd., include the appointments of **Arthur Hodgkinson** as vice-president in charge of finance; **Chipman H. Drury** as vice-president in charge of production; **Lloyd A. Bruce** as comptroller; and **Kenneth S. Gordon** as treasurer.

John Williamson has been named materials control supervisor for Hunt-Spiller Corp., Boston. He will be succeeded as storekeeper by **Alfonso Forzio.**

Elmer J. Carmody, formerly with C. C. Kawin Co., Chicago, is serving in an advisory capacity with the newly organized Engineering Foundry, Inc., Cedar Springs, Mich. He will also engage in general foundry consulting practice from an office in the new foundry. Engineering Foundry, Inc. was organized by Arthur V. Snell, Grand Rapids, Mich., for purpose of producing light gray iron pressure castings.

E. J. Carmody

John L. Shinn has been foundry sales engineer for Catalin Corp. of America since September 1. He is handling synthetic plastic binders for shell-molding and core making, and casting resins for pattern production. He covers the middle-west from his headquarters at 221 N. LaSalle St., Chicago. Employed by Dayton Malleable Iron Co., Dayton, Ohio, until his recent change, he is a graduate of Ohio State University where he studied foundry practice.

Lester B. Knight, president of Lester B. Knight & Associates, Inc., has been elected chairman of the board and chief executive officer of Universal Castings Corp., Chicago. He was elected to the Universal board in 1946 when Knight Associates started operating the corporation under a management contract, an arrangement which will continue. Mr. Knight has recently become a member of the Subcommittee on Foundry Equipment of the Munitions Board's Foundry Advisory Committee. Simultaneously, it has been announced, Lester B. Knight & Associates has been elected to membership in the Association of Consulting Management Engineers. Knight Associates, with offices in Chicago and New York was organized when Mr. Knight left the Navy in 1945. Since its establishment the organization has modernized 40 foundries and designed new plants here and abroad.

Donald Smith, for six years plant manager of the Peerless plant of Wellman Bronze & Aluminum Co., Cleveland, has been appointed general plant manager of both the Wellman Superior and Peerless plants. A native of Scotland, where he completed his apprenticeship, Mr. Smith came to the United States in 1928. He was assistant superintendent of Aluminum Co. of America's Bridgeport, Conn., foundry when he joined Wellman.

Donald Smith

Harold S. Falk, president of the Falk Corporation, Milwaukee, was recently honored by his employees at the company's annual dinner, November 4, when he was presented with a 50-year service pin. In token of appreciation for his leadership, members of the Falk '92 Club (retired employees) and Employees' Club presented Mr. Falk with a gold watch and with a leather-bound volume signed by every one of the company's 1800 employees and bearing the inscription, *"Throughout the years we have appreciated your leadership, admired your ability and valued your friendship. Your record during the past half century has been a foundation for our confidence in the future of our company."* A pioneer in the development of foundry and apprentice training methods, Mr. Falk was awarded the A.F.S. John A. Penton Gold Medal in 1939 for his work in this field. This fall, Mr. Falk received the National Metal Trades Association's Industrial Achievement Award for "energetic and forthright efforts on behalf of equitable working conditions, contributions to industrial education and foreman and apprentice training."

W. J. MacNeill, formerly assistant to the president of the Dayton Malleable Iron Co., Dayton, Ohio, became foundry manager of Acme Aluminum Alloys, Inc., Dayton, on November 15 according to Acme President B. D. Claffey. Simultaneously, he announced that his son, **James D. Claffey,** associated with General Malleable Corp., Waukesha, Wis., since the war, had resigned to become core room superintendent for Acme.

Mr. MacNeill is a graduate of the University of Indiana (1919) and has a mas-

W. J. MacNeill

ters degree from Wisconsin (1926). Starting as a student-apprentice with Federal Malleable Co., West Allis, Wis., in May 1919, he rose to become president and general manager. In 1945 he was named general manager of the G.H.R. Div. of Dayton Malleable Iron Co.

James Claffey is a graduate of Purdue University and was a lieutenant in the Marine Air Corps. B. D. Claffey and W. J. MacNeill are past national directors of A.F.S. and past presidents of the Wisconsin Chapter.

Tracy C. Jarrett has been named Midwest representative for C. I. Hayes, Inc., Providence, R. I., manufacturers of heat

T. C. Jarrett

treating furnaces and allied equipment. He will have charge of an area west of the Mississippi to the Rockies and will make his headquarters in Denver. Dr. Jarrett's career includes teaching of metal

(Continued on Page 87)

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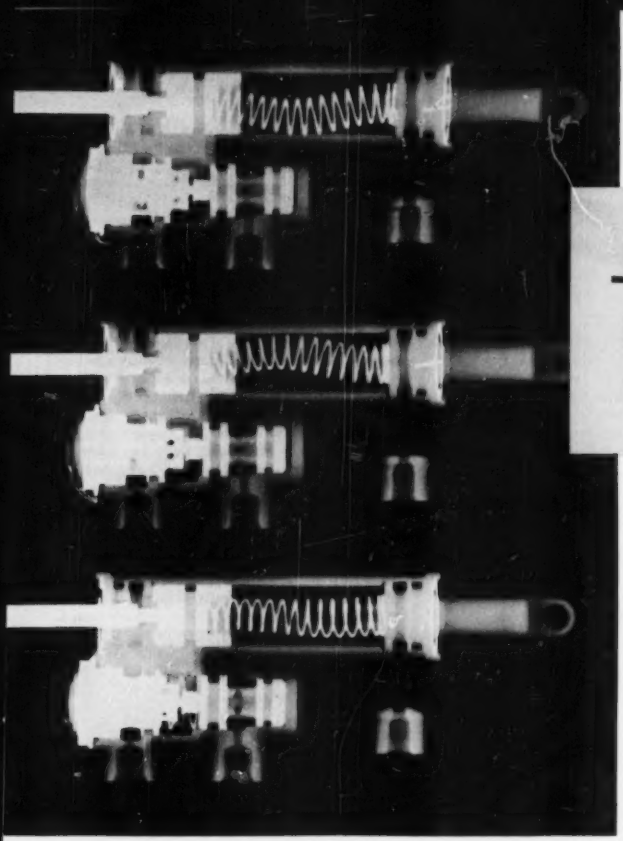
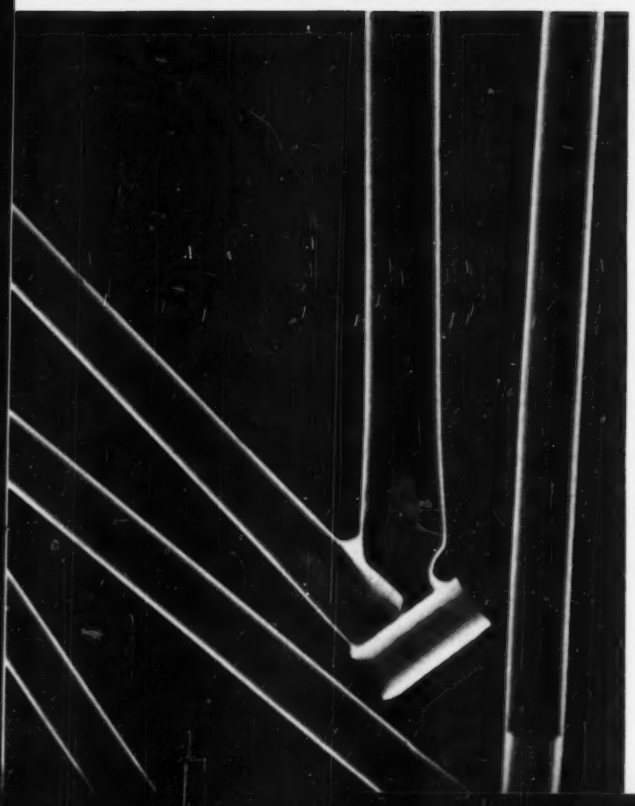


RADIOGRAPHY

goes beyond inspection of castings and welds

CHECKS ASSEMBLIES

Two of a group of hydraulic cylinders failed to function. Disassembly would have taken too long and involved breaking seals. Radiography compared the two with a good cylinder and revealed not only the compression springs rubbing on cylinder walls but also the absence of a second coil spring in the valve assemblies.



EXAMINES ENCLOSED SURFACES

Even though treated and sealed, these landing gear struts of an amphibian plane can develop internal corrosion and become weakened. Radiography alone can provide an examination of these internal surfaces. So the manufacturer has made it routine in the periodic inspection for service and safety of its amphibians.

Your x-ray dealer will gladly discuss the many ways radiography can aid your business by increasing foundry yield, checking welds and doing many other important and valuable non-destructive inspections.

EASTMAN KODAK COMPANY
X-Ray Division, Rochester 4, N. Y.

Radiography . . .

another function of photography

Kodak
TRADE-MARK

NEW Foundry Products

Railway Car Handler

1—Designed for easy, economical hauling, spotting and switching of railway cars in industrial plants and yards, the Whiting gasoline-powered Trackmobile will pull or push loads up to 150 times its own weight of 6000 lb. Fitted both with steel railway wheels for track travel and pneumatic tires for ground travel, the Trackmobile easily travels from track to track without the need for backing and switching. Developing a maximum drawbar pull of 7350 lb, the Trackmobile

couples to any standard railway car by means of driver-operated controls. Single operator also controls transfer from railway wheels to tires almost instantaneously. Maximum ground speed is 25 mph; track speed varies with load. In recent Chicago demonstration before industrial, railway, Army and Navy officials, the Trackmobile easily shunted six cars and a locomotive—a combined weight of more than 900,000 lb. *Whiting Corp.*

Portable Vacuum Cleaner

2—Small portable vacuum cleaner incorporates heavy duty advantages of larger machines. Holfco-Vac No. 15 is a 1½ hp

machine which operates one 35-ft length of vacuum hose. Overall dimensions are compact to permit almost unlimited maneuverability of cleaner in narrow aisles or congested areas. Width is 21½ in., length 40½ in., and height 43½ in. Features are dust container with adequate capacity for continuous service; dust separator fitted with four inverted filter bags; tangential inlet to separator to prevent direct impact on bag; and release of dust container by quick-acting lever. Unit can also be fitted with Class I Group D and Class II Group G motors for use in hazardous locations. *U. S. Hoffman Machinery Corp.*

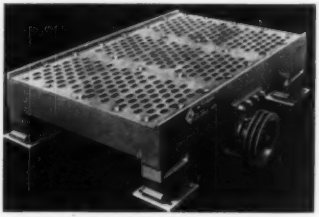
Core Baking Unit

3—Termed the "one man coreroom" by its manufacturer, Model 300-T electronic core baking turntable has a capacity of 350 lb of sand cores per hr. Unit is capable of baking cores up to 15 in. wide, 28 in. long and maximum combine height of core and core plate of 8 in. The 72-in. diameter turntable has adjustable speeds of 0 to 6 fpm. Core blowers, rollover ma-

chines and benches can be adjacent to turntable. Coremaker places green cores, core plates or driers directly on moving table; removes finished baked cores, and can reuse core plates and driers immediately. Cooling and storage racks are eliminated. All fumes are exhausted directly from coreroom. Since heat is generated within cores, no heat is given off into surrounding atmosphere. Unit has all components in single housing and features water-cooled tubes, manually operated electrode adjustment that requires no resetting during entire production run, and automatic adjustment of power consumption. *Induction Heating Corp.*

Small Shakeouts

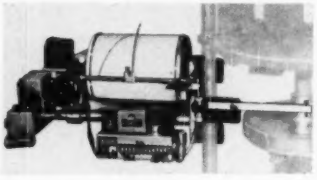
4—Foundromatic line of two-bearing shakeouts has been extended to include smaller general purpose units with capacities from 2,000 to 5,000 lb for smaller foundries. Units have simplified mechanism which can easily be removed from shakeout body. Drive shaft requires only one dust seal. Sheave is eccentrically bored to eliminate transmission of operating amplitudes to motor. Unit has bottom plates of rubber mountings for bolting to the foundation, baffle plates for diverting sand toward center of collecting hopper and transverse stiffeners in the body for deck support. Smaller shakeout can be installed with deck horizontal or sloped for discharging duty. Portable bases are available. Shakeout can be had with optional high side skirt boards, skid bar decks and various punched perforations on deck up to 2 by 4 in. Foundromatic shakeouts are available in single units ranging from



2,000 lb to 50,000 lb capacity and in multiple units from 16,000 to 200,000 lb total capacity. *Allis-Chalmers Mfg. Co.*

Hot Deformation Accessory

5—No. 791 Hot Deformation Recorder provides an accurate means for measuring hot deformation of foundry sands. Recorder determines whether or not a particular sand has the ability to deform while hot, i.e., if sand mass possesses



enough plasticity, expansion will be taken up in the grain-to-grain contacts and no rupture will occur to cause casting surface defects. An indicating model, the No. 790 Hot Deformation Indicator is also available. *Harry W. Dietert Co.*

Copper Cleaning Shot

6—Designed for cleaning of non-ferrous castings, copper slot eliminates possibility of sand or steel grit used in blasting becoming imbedded in castings. Harrison L/D Copper Shot can be used in either air or wheel machines for all types of non-ferrous castings and pieces

and is applicable to all types of cleaning and finishing where a light finish is desired. Shot is made from copper wire in the form of cylinders, with length of each cylinder equal to its diameter. During use, cylinders round-up to form spheres. Cylinder edges provide cleaning action and the round balls work surface to yield finish. Each piece is exactly alike and resistance to wear and re-use over long periods are features of L/D Copper Shot. *Harrison Abrasive Div., Metals Disintegrating Co.*

Self-Eliminating Core Wire

7—Meteor wire is a non-rusting magnetic core wire that disintegrates after it has maintained core rigidity during coremaking and the pouring operation. A special metal combination having high strength, the new core wire will not stick or fuse to castings. Eliminates tedious and costly removal of wires by breaking down to powder-like products which readily shake out with the sand, thus shortening cleaning lines and speeding operations. Meteor core wire is in use in iron and steel foundries and is particularly suitable for engine block and head cores, air compressor cylinder head cores, steam and hot water radiator cores, cores for liquid cooling, pump jackets and other intricate cores. Test samples are available. *E. J. Schwoegler Co.*

Metal Dust Collector

8—Self contained, portable metal dust collector is designed for use wherever disposal of metal dust is essential to health of workers and protection of machinery. Universal in application, dust collector's openings can be attached to all types of abrasive units, making it applicable to grinding, sanding, polishing and buffing operations. In operation, unit's fan sucks both fine and coarse dust and small particles through air filter. Larger particles fall into easily-removed pan at bottom of collector. Squirrel cage fan removes 350 cfm of air. Filter is fireproof and easily cleaned. Lubricated-for-life motor is housed in dustproof compartment. *Power Tool Div., Rockwell Mfg. Co.*

Storage Racks

9—Arc-welded structural steel Storage Racks provide maximum strength without bulk or weight and are made with or without bottom rails, permitting storage of first tier directly on floor by means of a lift truck. Storage Rack line includes both barrel and skid racks to permit maximum use of plants' cubic footages. Portable elevator carries load to storage, lifts it and spots it in rack. Barrel and skid racks can be piled ceiling high and old stock is never buried. Leaky containers are easily spotted and grades are properly separated. *Barrett-Cravens Co.*

Foot Treatment Equipment

10—Miracle Mat and Reservoir is designed to dispense Foam-X Solution, a non-toxic fungicide for eliminating athlete's foot and other infections in industrial shower rooms. Plastic reservoir holds one gallon of Foam-X and automatically feeds it into sponge rubber mat as solution is used up. Solution remains at same level in mat, eliminating over-filling, splash and waste. Mat and reservoir hold about 1500 foot treatments. Two-week test of Miracle Mat and Reservoir and Foam-X Solution is available without cost or obligation. *Foam-X Co.*

All-Plastic Safety Goggle

11—Saf-I-Duo all-plastic safety goggle features removable and interchangeable one-piece plastic lens. The same lens will fit both the Saf-I-Duo and Saf-I-Spec, making it necessary to purchase only one replacement for both goggles and spectacles. Interchangeable lens is made from optilite, new optical safety plastic available in clear or anti-glare green. Goggle frame is made of soft vinyl and is not affected by acids or alkalies. Lightweight, Saf-I-Duo offers full protection from all impact hazards and effects a tight seal against the face, offering protection from dusts, acid splashes, etc. Will fit over personal glasses. *U. S. Safety Service Co.*

Versatile Materials Handler

12—Hydraulic Traveloader does the work of several materials handling machines—fork lift truck, transporter, yard crane, spooled cable reeler and strip steel carrier. Side-loading Traveloader handles lengthy materials and operates in aisles where front-lift unit cannot enter or maneuver. One operator lifts load, puts it aboard, delivers it to destination, stacks it, transfers it to truck or rail car or places it on racks for storage. Performs complete loading cycle of loads up to 10,000 lb in 20 seconds. Unit lifts, loads, unloads, stacks, travels, handles pallets, lumber, pipe and bulky loads. Extends and lifts loads up to 10,000 lb to height of 12 ft and out to 64 in. *Lull Mfg. Co.*

Portable Spot Welder

13—Model BW Portable Spot Welder answers need of metalworking shops for welder that is portable but can be converted to floor model. Manufacturer claims increased power, faster welding, easier handling, and greater versatility for this 33-lb unit, which has automatic switch control and can weld up to ¼ in. combined thickness of mild or stainless steel, or 2 pieces of 16-gage galvanized metal with a combined thickness of ⅛ in. Slight squeeze of spot welder handle applies pressure to welding tips. Extra squeeze turns on current. Release of pressure cuts off current and separates welding tips. Copper welding arms are available in 6, 12 and 18 in. lengths in a variety of shapes and sizes. Unit can be mounted on metal stand as stationary model, with operating pressure applied by foot pedal. Unit can again be used as portable welding tool by removing two metal brackets holding spot welder to stand. *Greyhound A-C Arc Welder Corp.*

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FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature mail postcard below to Reader Service, American Foundryman, 616 S. Michigan Ave., Chicago 5. Refer to items by circling the convenient code numbers.

Phenolic Resins

14—Comprehensive Bulletin CDC-176, *"Phenolic Resins for Foundries,"* presents technical data on fast baking resin core binder G-E 12300. Bulletin includes baking curves with complete data on green and baked core properties, recommended core mixes and recommended mixing and baking instructions. *General Electric Co.*

Cutting Wheels

15—Six-page folder announces moisture proof protection being given Chicago Cut-Off Wheels, a process claimed by manufacturer to increase wheel efficiency as much as 10 per cent and to protect them from moisture, dirt, oil and grease. All Chicago wheels are now protected by heat-sealed glassine envelopes to insure that wheels are always clean and ready to use. *Chicago Wheel & Mfg. Co.*

Railway Car Handler

16—Bulletin TM-101 describes features and applications of the new Whiting Trackmobile, a gasoline-powered unit that economically switches, spots and hauls railway cars in industrial plant sidings and yards. Capable of moving some 900,000 lb of rolling equipment, the Trackmobile weighs only 6000 lb and is equipped with railway wheels and with pneumatic tires, instantly interchangeable for operating from track to track without switching. One operator controls all coupling operations from driver's seat and transfer from rail to road operation. Unit achieves up to 25 mph on road, with track speeds varying according to weight of load being shunted. *Whiting Corp.*

Portable Core Ovens

17—Bulletin 206 illustrates and describes Coleman Shelf Type and Rolling Drawer Core Ovens, with recirculating systems for gas, oil or electricity. These units are claimed by manufacturer to provide fast baking, continuous operation, reduced labor costs, lower fuel consumption and saving on floor space. *The Foundry Equipment Company.*

Vibrating Screens

18—Book No. 2354 illustrates and describes "CA" Concentric Action Vibrating Screens for medium and heavy duty service, rinsing and dewatering of a wide range of foundry materials. Detailed dimensions, weights and other engineering layout data are given, including a page on selection of screen sizes for handling a given capacity of material per hr over square openings up to 3 in. *Link-Belt Company.*

Liquid Parting

19—Service Bulletin No. 9 describes uses of Thor Liquid Parting TNG-9 in improving foundry sand mixes and providing superior release characteristics. Formulated for use with plastic core-binding resins, TNG-9 is added at the muller as the final addition to core mix, producing a mix that flows and releases easily from coremaking equipment. Recommended by manufacturer for both urea and phenolic resin binders. *Borden Co., Chemical Div.*

Fire Brick

20—Bulletin presents data on selection of refractory fire brick. Properties and typical applications of Ironton Peerless Fire Brick are outlined and uses of Alset air-setting bonding mortar are given. Peerless Fire Brick is claimed by manufacturer to be resistant to slag erosion, clinker action and abrasion at high temperatures. *Ironton Fire Brick Co.*

Heavy Duty Portable Conveyor

21—Bulletin 374 describes applications, features and operation of Barber-Greene Model 374 Heavy Duty Portable Conveyor. Illustrated are such accessories as feeders, screens, hoppers, etc. *Barber-Greene Co.*

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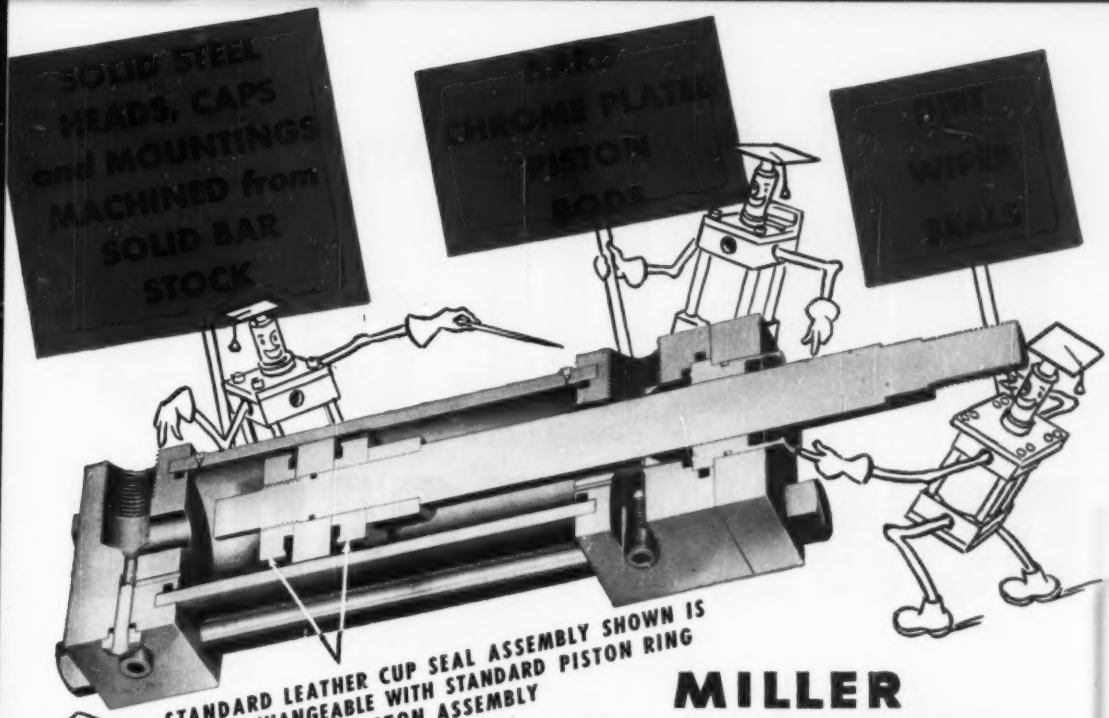

STANDARD LEATHER CUP SEAL ASSEMBLY SHOWN IS INTERCHANGEABLE WITH STANDARD PISTON RING PISTON ASSEMBLY

MILLER *High Pressure* HYDRAULIC CYLINDERS *Meet* J. I. C. HYDRAULIC STANDARDS

Years before the Joint Industry Conference (J. I. C.) Standards for specifying "quality" hydraulic equipment were adopted, the *standard* design and construction features of Miller High Pressure Hydraulic (2000-3500 psi) Cylinders already included ALL the specifications for cylinders, seals and pistons now called for by the "Standards". Hard chrome plated, scratch-resistant piston rods and dirt wipers have long been standard Miller cylinder features yet are required by the "Standards" only under severe conditions.

Solid steel heads, caps and mountings which eliminate costly, dangerous breakage even under the severest operating conditions represent an "extra-quality" standard Miller cylinder feature which actually exceeds the high quality set by the J. I. C. Standards.

The Miller "Patented" Hydraulic Piston Rod Seal which has no manual adjustment and is automatically self-adjusting and wear-compensating to give life-long leakproof service without ever requiring any manual adjustment whatsoever . . . far surpasses the requirement of J. I. C. Standard H6.2.5 which specifies "Stuffing boxes for automatic packing shall be so designed as to prevent adjustment beyond the functional limits of the packing"

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

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Full technical service, without obligation, is available to show how you can profit from the use of MOGUL Cereal Binder in your production.

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PERSONALITIES

(Continued from Page 79)

lurgy at the South Dakota School of Mines and Harvard University and active participation in technical committee work of A.F.S., ASM, AIMME and SAE. He was formerly manager of engineering and research for the Koppers Co., Piston Ring Division, Baltimore, where he invented automatic metallurgical polishing equipment now in wide usage.

Frank S. Brewster has been appointed general manager of the Harry W. Dietert Co., Detroit, at a meeting of the firm's board of directors October 20. Holder of a metallurgical engineering degree from Michigan State College in 1926, Mr. Brewster served as metallurgist for Atlas Drop Forge Co., chief chemist with GMC's Saginaw Malleable Iron Division, chief metallurgist with Baker-Perkins Co., and sand engineer for Dow Chemical Co.'s magnesium foundry. He joined Dietert as sales manager in 1946. Mr. Dietert retains his position as president of the firm.

R. L. Lucien, who for the last year has served as general manager of Foundry Services (Canada) Ltd., Toronto, will shortly return to Europe, where he will resume his activities as overseas technical manager for the company. Mr. Lucien will be succeeded as general manager by **Denis A. Dodson,** who will be assisted by a technical staff coming from England.

Clyde E. McQuiston, formerly a member of the Industrial Planning staff of Wright Field, has been named to succeed the late Professor **Rudolph P. Schneider** of Ohio State University's mechanical engineering staff as instructor in foundry technology. An engineering graduate of Purdue University, Mr. McQuiston received his M. Sc. from Ohio State University. Prior to his connection with Wright Field, he was an engineer for the Hamilton Standard Propeller Co., Hartford, Conn.

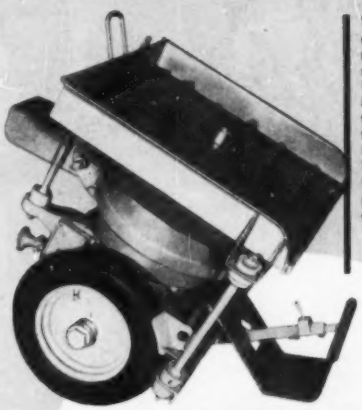
George R. Siegrist, executive vice-president, treasurer and director of Acheson Colloids Corp., Port Huron, Mich., has announced his retirement because of ill health after 40 years' service with the company. Mr. Siegrist joined Acheson in 1911 and later was transferred to the company's plants in Verviers, Belgium; Novara, Italy; and Epinol, France. Rejoining the Port Huron headquarters of the firm in 1920, he was elected treasurer in 1928 and appointed executive vice-president and director in 1932. Mr. and Mrs. Siegrist will live in Laguna Beach, Calif.

O. W. and **W. M. Potter** of 1803 Princeton Ave., St. Paul, Minn., have been named Minnesota representatives for the Iron Fire Brick Co.

M. E. Puyans and **Richard McAvoy** have been elected vice-presidents of Great Lakes Carbon Corp., New York. In addition to their new responsibilities, Messrs. Puyans and McAvoy will continue to serve as treasurer and general counsel, respectively. Simultaneously, it was an-

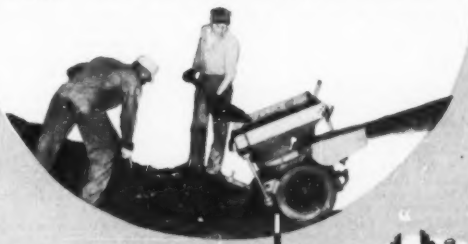
NOW...MORE THAN EVER

the Lowest Cost sand conditioner!



Improved features of design and construction make the Screenarator—now, more than ever—the lowest cost sand conditioner! The Screenarator is lowest in original cost and lowest in maintenance cost per ton of sand thoroughly conditioned. Its simple, tested design and rugged construction assure trouble-free performance. Thousands of Screenarators in foundries throughout the world have proved to be unbeatable sand conditioning investments.

THE SCREENARATOR



Three Screenarator models with capacities of 20 to 45 tons per hour produce thoroughly screened, twice aerated, lump free, fluffy, flowable sand. All types of sand are prepared with the same thoroughness and economy. Both jobbing and production foundries find that the Screenarator pays for itself in a short time. Write today for a Screenarator bulletin!

1. Move it to any foundry floor

2. Plug into a power outlet

3. Screen, double aerate and discharge the sand

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DIVISION OF PETTIBONE MULLIKEN CORPORATION

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Manufacturers of the Sandslinger • Speedslinger • Hydro-Slinger • Speedmuller • Multiaire • Screenarator • Nite-Gang • Junior Nite-Gang • Preparator • B&P Combination Sand Conditioning and Mulling Unit • B&P Champion Speed-Draw • B&P Plate Feeder • B&P Turntable • B&P Gyratory Screen

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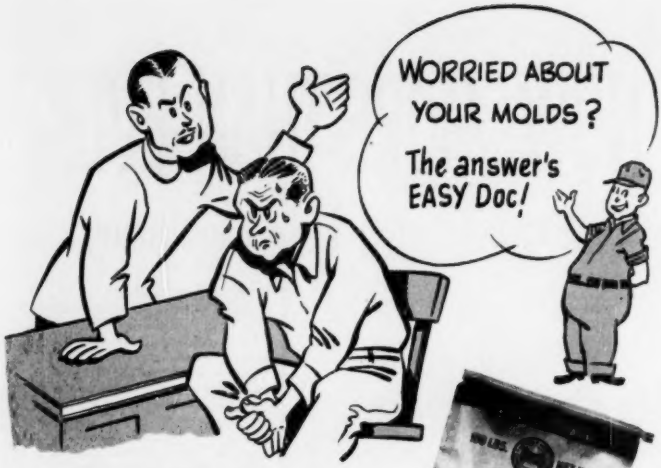

CONSISTENTLY HIGH QUALITY NATIONAL BENTONITE

takes many worries from a foundryman's mind, because it gives molding sands maximum green strength with low moisture content, thus lessing the danger of gas holes or blows. National Bentonite also gives high dry strength . . . excellent hot strength at 2500° F. Provides harder cores, too.

These APPROVED DISTRIBUTORS will give you quick service

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Houston, Texas - New Orleans, La.
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Combined Supply and Equipment Company
215 Chandler St., Buffalo 7, N. Y.
The Foundries Materials Co.
Coldwater, Mich. - Detroit, Mich.
Foundry Service Company
North Birmingham, Alabama
Foundry Supplies Co.
Chicago, Illinois
Robert C. Penner
Interstate Supply & Equipment Co.
647 West Virginia St.,
Milwaukee 4, Wis.
Independent Foundry Supply Co.
Los Angeles, California
Industrial Supply Co.
San Francisco, California
Klein-Farris Co., Inc.
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LaGrand Industrial Supply Co.
Portland, Oregon
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Carl F. Miller & Co.
Seattle, Washington
Pennsylvania Foundry Supply & Sand Co.
Philadelphia, Pennsylvania
Robbins & Bohr
Chattanooga, Tennessee
Smith-Sharpe Company
Minneapolis, Minnesota
Southwest Foundry Supply Co.
Houston, Texas
Steelman Sales Co.
Chicago, Illinois
Stoller Chemical Co.
227 W. Exchange Ave.
Akron, Ohio
Wehenn Abrasive Co.
Chicago, Illinois
Mr. Walter A. Zeis
Webster Groves, Missouri

BAROID
SALES DIVISION
NATIONAL LEAD COMPANY

BENTONITE SALES OFFICE
RAILWAY EXCHANGE BLDG.
CHICAGO 4 • ILLINOIS

nounced that **W. O. Ashe, Jr.,** and **J. W. Meader** have been elected assistant treasurers. Mr. Ashe will also continue to serve as credit manager and Mr. Meader as economist for the company. Mr. Puyans joined the company in 1945 after 18 years with the New York Trust Co., and Mr. McAvoy came to Great Lakes Carbon in 1917 after 10 years with General Electric.

Walter C. Troy has been named assistant chairman of the Metals Research Department of Armour Research Foundation, Illinois Institute of Technology. Holder of a bachelor's degree from the University of Notre Dame in 1933, Mr. Troy later attended Carnegie Institute of Technology before spending nine years with Westinghouse Electric Corp. prior to joining Armour in 1947.

William E. Mulcahy has rejoined Hunt-Spiller Mfg. Corp., Boston, as assistant foundry superintendent. Prior to an association earlier this year with Boston Electro Steel Co., Mr. Mulcahy had served with Hunt-Spiller as castings inspector, assistant chipping room foreman, cleaning department foreman, assistant works manager and in his present post.

B. S. Stephenson, president of the Tonawanda Iron Division of the American Radiator & Standard Sanitary Corp., Pittsburgh, announced his retirement effective November 1 in accordance with the company's retirement plan. A graduate of Ohio State University, Mr. Stephenson joined the reportorial staff of the Columbus, Ohio, *Citizen,* becoming city editor and managing editor at the age of 25. He left the *Citizen* to become an associate editor of *Iron Trade Review,* forerunner of *Steel* magazine. Five years later Mr. Stephenson became resident agent for M. A. Hanna & Co., Cleveland, and left that position to become a director of the American Radiator Co. and subsequently, vice-president in charge of purchases. He was named president of Tonawanda, an American Radiator & Standard Sanitary Corp. subsidiary, in 1938. Mr. Stephenson was prominent in industrial war committee work in both world wars, helping to allocate pig iron in World War I and serving with the pig iron committee of WPB and as chairman of the merchant pig iron industry advisory committee to OPA in World War II.

H. K. Ihrig has been elected vice-president in charge of research of Allis-Chalmers Mfg. Co., Milwaukee. Dr. Ihrig was formerly vice-president and director of laboratories of the Globe Steel Tubes Co., Milwaukee. He was cited in 1949 by the University of Wisconsin College of Engineering for his important contributions to the science of metallurgy, and in 1947 was awarded the Robert W. Hunt medal of the American Institute of Mining and Metallurgical Engineers for the best paper published on ferrous metal research.

John T. M. Frey has been named assistant manager of the New York branch and Lamar S. Hilton assistant sales manager of the Abrasive Metal department of Man-

(Continued on page 92)

Quantity
PRODUCTION
of
GREY IRON CASTINGS

*

ONE OF THE NATION'S
LARGEST AND MOST MODERN
PRODUCTION FOUNDRIES

*

ESTABLISHED 1866

THE WHELAND COMPANY

FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS

CHATTANOOGA 2, TENNESSEE

FOUNDRY FIRM *Facts*

Trabon Corp., with offices at 122 south Michigan Ave., Chicago, and plant in South Bend, has changed its name to Kordell Industries, Inc. The organization will continue to manufacture and sell oils, chemicals and foundry supplies.

Roto-Finish Co., Kalamazoo, Mich., is rapidly completing construction of a new addition to its present plant. The new unit is designed to increase greatly the company's processing machine manufacturing facilities, President D. T. Barrett recently stated.

Industrial Foundry Corp., a new organization for the manufacture of nonferrous castings, has opened its offices and plant at 6321 Foster St., Houston 4, Texas. Heading the new firm is President Marvin W. Williams, past chairman of the A.F.S. Texas Chapter. Mr. Williams was formerly with Hughes Tool Co., Houston for 15 years, and was foundry manager for the last five.

Alliance Brass & Bronze, Inc., newly-opened Alliance, Ohio, foundry will specialize in the production of special and commercial alloy castings in bronze and aluminum. Heading the new firm is Lee Draper, formerly general manager of the Akron Bronze & Aluminum Co., Akron, Ohio. Mr. Draper attended the University of Cincinnati and Northwestern University before becoming foundry foreman and metallurgist for Howard Foundry Co., Chicago. He was production manager of the Eljer Co.'s foundry at Marysville, Ohio, prior to joining Akron Bronze & Aluminum.

Arwood Precision Castings Corp., Brooklyn, N.Y., announces the opening of a New England branch plant at Groton, Conn., to speed delivery of vital military and non-military products. Production facilities of the company's Brooklyn plant have been taxed by a 262 per cent sales increase for the first nine months of 1950 and the new branch plant, by doubling the firm's production, is expected to meet an anticipated growth in defense and consumer demand. The Groton plant is equipped with new machinery designed by Arwood engineers for precision investment casting of non-ferrous alloys. The plant, laid out by M. F. Wendt, Arwood vice-president in charge of manufacturing, utilizes a continuous-flow foundry production technique.

Robins Conveyors Div., Hewitt-Robins, Inc., announces the removal of its Cleveland office from 215 Rockefeller Bldg. to 8905 Lake Ave.

WPB and World War II Copper Industry

GOVERNMENTAL CONTROL of the copper industry in World War II is the subject of a 56-page booklet recently published by John W. Douglas, president of Republic Foil and Metal Mills, Inc., Danbury, Conn., who served as assistant chief of the Copper Division of WPB.

A searching review of WPB and the wartime copper industry, this booklet is designed to help the metals industry avoid the problems, confusion and production losses of World War II in the present national emergency.

Copies of *"Government Administration of the Copper Industry — World War II"* are available at $1 each from John W. Douglas, Republic Foil and Metal Corp., 55 Triangle St., Danbury, Conn.

Iron Once Considered Precious Metal

Ancient Egyptians once considered iron a precious metal. As early as 322 B.C., iron was cast into various forms for making swords, armor and ornaments, while other evidences of iron used as a precious metal date back some 8,000 years—*White Metal News Letter.*

General Foundry & Mfg. Co. Holds Four-Day Open House

Host to some 750 persons at a four-day open house, held November 1 through 4, was General Foundry & Manufacturing Co., Flint, Mich. First group to be guests of the company were some 50 members of the local Chamber of Commerce and civic organizations, who toured the plant and ate luncheon in the Administration building on November 1. On November 2 and 3 approximately 100 representatives of various customer firms were also luncheon and plant tour guests. Climaxing the four-day silver anniversary open house celebration was a conducted tour through the foundry and adjoining departments and a buffet luncheon for some 600 employees and their families. (Above, left) Guide Paul Van Amburg, assistant personnel director, and employee family group watch Coremaker Louis Sedrick at work. (right) Employees of the company and their families enjoying a hearty buffet lunch in the pattern shop.

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How CHROMIUM BRIQUETS Increase Hardness and Strength of Cast Iron

Chromium briquets are made especially for the addition of chromium to cast iron in the cupola. The amount added may vary from small percentages up to as high as 15 per cent.

Function of Chromium in Cast Iron

Chromium is added to cast iron for the purpose of refining the grain and stabilizing the combined carbon content, thus increasing strength, hardness, and resistance to wear and abrasion. Even very small additions of chromium have a decided effect, and as little as 0.25 to 0.50 per cent will yield a great improvement in iron used for resistance to wear. A typical application is in automotive cylinder castings, particularly in heavy-duty truck and tractor work.

The stabilizing and refining effect of chromium is particularly useful to foundrymen producing castings of medium to heavy section. The slow cooling of such castings often results in weak, open-grained iron. Chromium in amounts up to 1.00 per cent will increase the stability of the structure of the castings and help to offset the effect of slow cooling in the mold.

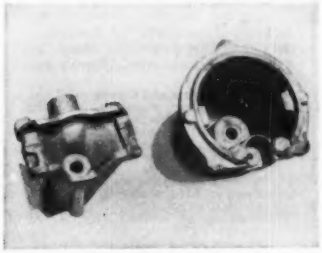

Fig. 1—These low-chromium iron castings, which are parts for a die-casting machine, are machinable, uniformly hard, and resistant to the effect of high temperature.

High-Temperature Service

The strong effect of chromium in stabilizing the structure of gray iron has made its use in iron subjected to high temperatures almost universal. Chromium in the range of 0.75 to 1.25 per cent greatly reduces the growth and warping that occur in unalloyed irons as the result of repeated heating and cooling. Chromium cast irons in this range of chromium content may be inoculated with silicon alloys to decrease the tendency to chill and, also, to assist in maintaining machinability. Such irons are adaptable to various high-temperature applications, such as melting pots, die-casting machine parts, grate bars, etc.

How Binder Protects Chromium

For the addition of chromium to cast iron, ELECTROMET produces briquets containing exactly 2 lb. of chromium each. The alloy is protected by a refractory binder, which has a high melting point and, therefore, helps to prevent oxidation of the chromium until it is melted and delivered to the crucible of the cupola.

The recovery of chromium from "EM" briquets is thus uniformly high, normally above 85 per cent, and it is easy to obtain the desired final chromium content. This is of particular importance when the limitations of hardness and machinability for a casting demand close chemical control.

Typical Briquet-Iron Mixture

The use of "EM" chromium briquets in the production of cast iron of low chromium content is shown in the table below.

Fig. 2—"EM" chromium briquets are hexagonal in shape, and each contains exactly 2 lb. of chromium. Notched briquets (right), which are easy to break in half, can be purchased for use when 1 lb. additions of chromium are desired.

The mixture given is for a medium-strength iron used for castings in which resistance to wear or heat is required.

Booklet Available

Typical briquet mixtures for other types of irons are given in the booklet "Briquetted Alloys for the Iron Foundry Industry." This booklet also contains information about "EM" briquets of silicon, silicomanganese, and ferromanganese. If you would like a copy, free of charge, simply write to the address given above or to the ELECTROMET office nearest to you. Offices are in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York and San Francisco. In Canada: Welland, Ontario.

The terms "EM" and "Electromet" are registered trade-marks of Union Carbide and Carbon Corporation.

Typical Briquet Mixture for Low-Chromium Iron

Base Charge			Alloys in Charge Material					
			Silicon		Manganese		Chromium	
Per Cent	Lb.	Material Charged	Per Cent	Lb.	Per Cent	Lb.	Per Cent	Lb.
20.0	200	Pig Iron	2.25	4.50	0.85	1.70	—	—
30.0	300	Return Scrap	2.00	6.00	0.75	2.25	0.57	1.71
30.0	300	Purchased Scrap	2.00	6.00	0.65	1.95	—	—
20.0	200	Steel Scrap	0.10	0.20	0.45	0.90	—	—
100.0%	1,000 lb.	Total Base Charge		16.70 lb.		6.80 lb.		1.71 lb.
Briquets Required		5 Silicon Briquets		5.00		—		—
		1 Silicomanganese		0.50		2.00		—
		2½ Chromium Briquets		—		—		5.00
		Total Alloys Charged		22.20 lb. Si or 2.22% Si		8.80 lb. Mn or 0.88% Mn		6.71 lb. Cr or 0.67% Cr
		Melting Recovery		x .90		x .85		x .85
		Final Iron Analysis		2.00% Si		0.75% Mn		0.57% Cr

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PERSONALITIES

(Continued from Page 87)

hattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N. J. Mr. Frey has been a member of the company's New York sales organization for several years and Mr. Hilton was formerly sales engineer.

Fred E. Haker, director of purchases for the Allis-Chalmers Mfg. Co., Milwaukee, for more than 50 years, has announced his retirement effective with his 70th birthday, October 28. Mr. Haker is succeeded by **Kenneth R. Geist,** who has served as assistant to the director of purchases for the last two years. Mr. Haker joined Allis-Chalmers' purchasing division, which then included himself and two others, in 1900. Today, the division employs some 200 persons. He was named assistant manager of purchases in 1916, general manager of purchases in 1940, and in 1946 became director of purchases. His successor is the 32-year-old son of Allis-Chalmers President Walter Geist.

Recent recipient of a 35-year service pin from Caterpillar Tractor Co. was President **Louis B. Neumiller,** who began as a clerk in the company's engineering office in 1915.

OBITUARIES

Timothy M. O'Brien, who retired as foundry superintendent of Clark Bros. Co., Inc., on January 1 of this year, died August 11 following a prolonged illness. Mr. O'Brien was first employed by Clark Bros. in 1898. He was for many years an active member of the A.F.S. Western New York Chapter.

George D. Hayes, 43, northern Ohio and Pennsylvania representative for the Stoller Chemical Co., Akron, Ohio, died October 5. For many years employed in supervisory capacities in the foundries of National Malleable & Steel Castings Co., Cleveland, Mr. Hayes was an active member of the A.F.S. Northeastern Ohio Chapter.

Rudolph P. Schneider, 66, for more than 30 years a member of the engineering faculty of Ohio State University, where he was assistant professor of foundry technology, died August 30 as a result of an automobile accident in Brookville, Ind., while enroute from the home of his son in Houston, Texas. At the time of his death, Professor Schneider was co-faculty advisor to the Ohio State University Student Chapter of A.F.S.

William Bowring, 61, sales engineer for Frederic B. Stevens, Inc., Detroit, in eastern Michigan for 35 years, died October 29 of a heart attack at his home in Windsor, Ont. Active for many years in the Detroit Foundrymen's Association, predecessor of the A.F.S. Detroit Chapter, Mr. Bowring was several times elected treasurer of that organization. In 1947, he served as chairman of the A.F.S. Detroit Chapter.

Frank Eastman, iron foundry manager for the Viking Pump Co., Cedar Falls, Iowa, died in that city September 25.

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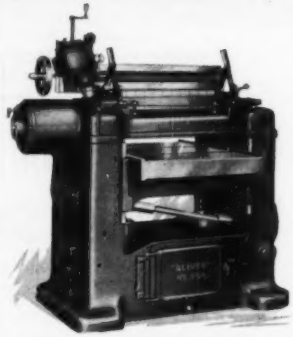

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CHAPTER ACTIVITIES

(Continued from Page 77)

The meeting was opened by Fitz Coghlin, Jr., retiring chapter chairman, who gave a brief resume of the activities of the chapter during the past year. After giving details of the business transacted at the last directors meeting, he introduced the officers for the coming year and turned the meeting over to incoming Chapter Chairman Jack Secor.

Fred Wagner, Centrifugal Fusing Co., was named a chapter director for the new year.

Robert D. Noyes, Bakelite Div., Union Carbide & Carbon Corp., at left, holds half of shell mold used by speaker Bernard N. Ames, left, New York Naval Shipyard, to illustrate his talk on the Croning Process at the October meeting of the Metropolitan Chapter. (Photograph courtesy John Bing, Metropolitan Refractories Corporation.)

Ohio State University

William M. Harper
Publicity Chairman

GUEST SPEAKER at the first meeting of the season was Dr. Laverne W. Eastwood, Battelle Memorial Institute, Columbus. Dr. Eastwood, who specializes in the technology of non-ferrous alloys, presented a film showing developments in light alloy gating.

Content of this film dealt with experiments which Dr. Eastwood and his associates at Batelle made during this past year. For demonstration purposes, Dr. Eastwood used a lucite mold which enabled the observer to watch flow of liquid.

The experiment was made with variations in sprue and runner shapes in the same mold. Many causes of defects were pointed out. Dr. Eastwood also stated that although many causes of

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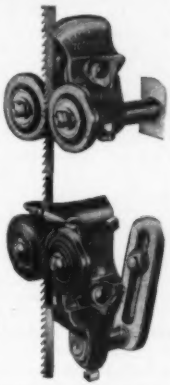

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defects were found he has not discovered ideal design for runners and sprues. He has filmed later experiments in color but at this time the new film was not available.

Prior to Dr. Eastwood's film presentation, Dr. D. C. Williams, director of the foundry option at Ohio State, informed the chapter of Professor Schneider's accidental death. Professor Schneider was very active in foundry work and was particularly interested in its development. Professor Schneider's duties are being taken over by C. E. McQuiston, a recent graduate of Purdue. Mr. McQuiston, along with the new members of the chapter, was given a warm welcome.

Following the meeting the chapter had an informal gathering at which refreshments were served.

Northwestern Pennsylvania

Earl M. Strick
Erie Malleable Iron Co.
Chapter Secretary

SPEAKER at the October 23 meeting, held in the Moose Club, Erie, was William Moore, Meehanite Metal Corp., who discussed *"Sand Control."*

In one of the best presentations in chapter history, Mr. Moore said that daily sand tests or squeezing a handful of sand do not constitute sand control and that keeping sand within certain property limits does not mean that it is under control.

Control, he said, involves first the selection of sands with properties that suit the foundry involved; second, measurement of those properties; and third, maintenance of sand within these property limits.

"We might say that sand control consists of doing the right thing at the right time," Mr. Moore continued, adding that four controls insure proper sand—(1) grain size, (2) clay bond, (3) auxiliary materials, and (4) moisture content.

In discussing grain size, he described the method of selection of grain and stated that when the correct selection of base grain has been made, due allowance should also be made for infiltration of core sands. Then periodical checks should be made to maintain the standard set. Regarding clay bond, Mr. Moore stated that it is necessary in molding sands to offset silica expansion and that poor flowability will result unless the plasticity of the clay is controlled. The clay in molding sands, he said, consists of: (A) Plastic or fine particle size which should be measured by hydrometer test; (B) Less plastic clay of large particles; and (C) Siliceous fines and dead burnt clay.

Effects and measurements of these different clays were discussed by the speaker, who showed how they effect permeability and toughness of sand. In using auxiliary materials use as little as possible, going as far as possible with sand grain and clay substance to do the job, Mr. Moore stated, adding that moisture has the same effect on sand properties as a variation in clay distribution; and that moisture must be varied to suit sand conditions.

Summarizing his talk, Mr. Moore stated that the simpler the sand mix and the simpler the clay, the better. Measure accurately, mull adequately, and study the condition of the castings and, above all, be sure you know why you are changing the mix before you change it and then change it in the best way, he concluded.

Ontario

O. A. Davies
Canada Metal Co.
Chapter Director

FIRST REGULAR MEETING for 1950-51 of the Ontario Chapter was held in Toronto at the Royal York Hotel.

This was a general group meeting on Pattern and Rigging. A. Reyburn, Cockshutt Plow Co., Ltd., was chairman, and Alex Pirrie, Gurney Dominion Furnaces, was the speaker. This in itself was a new venture as this chapter generally has an outside speaker for general meetings.

Mr. Pirrie's talk was divided into three parts and discussion periods were held after each part. The speaker did not try to describe anything new but reminded his listeners of many little things that help to make good casting easier. If only 50 per cent of this talk was absorbed by the members, foundrymen and patternworkers in Ontario will be working together more than before, Mr. Pirrie concluded.

Saginaw Valley

P. L. Banfield
General Motors Institute
Chapter Reporter

NOVEMBER 2 MEETING was held at Fischer's Hotel, Frankenmuth, Mich., and began with a deluxe chicken dinner, topped off by a coffee talk and film presented by Louis D. MacGregor on *"Big Game Hunting In British Columbia."*

Feature of the evening was a *"Casting Defect Clinic."* Defects of ailing castings were diagnosed by leading foundrymen of the chapter. Discussion was lead by Harry E. Gravlin, Ford Motor Co., Dearborn.

A criticism frequently heard was that there were too few samples on hand for the discussion. The foundrymen requested to furnish these castings claimed that although they tried to furnish samples, it was almost impossible for them to make defective castings in their foundries!

Southern California

S. L. Jackson
Electro Metallurgical Div., Union Carbide & Carbon Corp.
Publicity Chairman

OCTOBER MEETING was held at Rodger Young Auditorium, Los Angeles, October 6. Speaker for the evening was Michael Bock II, Exomet Incorporated, Conneaut, Ohio, who spoke on gating and risering.

Mr. Bock correlated the subject with problems caused by shrinkage in casting non-ferrous and ferrous metals, excepting bismuth, antimony and type-metal, which do not shrink during solidification.

Mr. Bock presented slides illustrating the mechanics of directional solidification in metals, and described top, parting line, and bottom gating, and explained the advantages and disadvantages of each with respect to feeding of metal to the casting to insure that clean and sound castings are obtained in the foundry.

Also shown were slides illustrating a step gate, strainer gate, horn gate and reverse horn gate. The speaker explained the advantages and disadvantages of each type of gate with regard to metal feeding and casting cleanliness. Castings produced by centrifugal methods were compared in quality to parts produced by forging and other metal fabricating methods.

In order to minimize the effects of shrinkage as much as possible, Mr. Bock described the use of exothermic material on top of the riser metal in order to retard heat flow and to promote directional solidification. Maintaining temperature and insulation of the hot metal results in an increased yield and a decrease in cleaning costs. As riser size is important in obtaining sound castings, Mr. Bock described how the use of this material can increase yield by reducing riser volume.

Oregon

J. A. Larkin
Electric Steel Foundry Co.
Chapter Reporter

CHAIRMAN James T. Brodigan, opened the October 16 meeting and announced that the Board of Directors of our Chapter had voted to contribute $1,000 to the A. F. S. Housing Fund. The members voted to meet this obligation by assessing each member $3 per year for three years. Norman Hall, Electric Steel Foundry Co., introduced new member Elbert Bentley, also of Electric Steel Foundry Co.

National Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif., spoke on the A. F. S. Housing Fund. He said the building will include a research laboratory that will be important, especially to small plants that get ideas, but cannot afford to do research on them.

As an example he mentioned the sandslinger, which got its start in a small foundry in Klamath Falls, Ore. Mr. Gregg also spoke on the problem of getting skilled foundry workers. Many foundries, he said, will have to clean up, improve conditions of safety and hygiene, and decrease air pollution both inside and outside the shops, if they are going to attract men. Regarding air pollution, he suggested that foundries get together with lawmakers in controlling smog and not leave it entirely to the civil authorities to make these laws. They are apt to set standards of air purity that would be economically impossible to meet, according to the speaker.

Program Chairman James T. Dorigan, Electric Steel Foundry Co., introduced the speaker of the evening, I. M. White, Pelton Water Wheel Co. His talk was on the steel castings used in the Grand Coulee Dam, and was made interesting and informative by the use of slides.

According to Mr. White, Grand Coulee Dam is the largest structure ever built by man, and was originally started as an irrigation project. The war intervened, and the Dam proved to be a life saver in providing power for the production of aluminum during the war. Since the war, the irrigation project has been continued, and now two of the 12 six-vane, 65,000 hp pumps are ready to be installed.

All 12 pumps will be capable of pumping 15 per cent of normal river flow for distribution to 1,200,000 acres of extremely fertile land in the State of Washington. A model pump was built at the California Institute of Technology, and many tests were made on which they strived to maintain an accuracy of 1/10 of 1 per cent. One test required eight months to complete, Mr. White stated.

Eason G. Miller, Assistant Inspector of Naval Material, gave a report on war priorities and inventory controls, which, he said, are being imposed on all metals.

Industries will be required to inventory their stocks, and future material allottments will be based on past and present normal work load requirements. Each industry will have to deplete its normal inventory before receiving more material. Defense Order numbers will be issued for priority jobs and orders with the earliest delivery date will be honored first. Orders will not be acceptable with over a 90-day delivery date. Regulations on priorities are obtainable from the United States Department of Commerce, the speaker concluded.

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Reproduction Machining Short Runs of Parts

94—METHOD LOWERS COST. H. J. Chamberland, 'Contour Machining Reproduces Forgings and Castings," *The Iron Age*, vol. 165, June 22, 1950, pp. 90-92.

A process known as contour machining is described for producing short runs of parts which would otherwise be made as forgings or castings. Depending upon the nature of the part and the quantity involved, substantial savings can be realized. Several illustrations of contour machined parts are shown.

Nodular Iron Performance

95—SERVICE DATA. "Nodular Iron's Record—Two Years Later," *Steel*, vol. 127, July 17, 1950, pp. 85-89, 100.

Performance data of nodular cast iron parts in actual service are reported by several companies. Photographs of parts weighing 1/3 oz to 6500 lb are shown and discussed. A typical ductile iron analysis is as follows: C, 3.52; Si, 2.39; Mn, 0.24; P, 0.077; S, 0.017; Ni, 1.5; and Mg, 0.090 per cent.

Croning Molding Process

102—EXTENSIVE RESEARCH CONDUCTED. Walter Patton, "Detroit Spending Millions on Foundry Process," *The Iron Age*, vol. 166, August 3, 1950, pp. 89-90.

The automotive industry has spent over two million dollars in research work for the high production of precision castings by the shell molding or Croning process. Some of the changes that could occur in the foundry industry by utilization of the process are as follows:

(1) Method is attractive to both large and small foundries from the standpoint of plant investment, yield and quality of the finished product. The over-all cost may be materially reduced.

(2) Foundries may become more highly mechanized than they are today, cleaner and more attractive places to work.

(3) Since the sand volume may be reduced more than 90 per cent, much of today's sand equipment may not be needed.

(4) Machining of some castings may be reduced as much as 75 per cent.

(5) Coremaking equipment may be simplified.

(6) Metal patterns made more accurately than present day patterns are required. These will cost more.

(7) Output per man-hour may be greatly increased as a result of more efficient processing and greater mechanization of foundry operations.

Corrosion-Resistant Cast Steel

96 — Service Conditions Promote Attack. J. W. Juppenlatz, "Cast 12 per cent Chrome Steels proved in Gas Wells," *Iron Age*, vol. 165, June 22, 1950, pp. 85-89.

In the gas-condensate industry considerable trouble was encountered in erosion and corrosion of cast carbon steel gas well christmas-tree fittings. At the top of the well, pressures of 2000-3000 psi and temperatures of 135 F are encountered. These factors accelerate corrosive attack. After conducting several laboratory and field tests, it was found that a cast 12 per cent chromium alloy steel performed best.

30-Ton Ductile Iron Castings

104—Effects of Section Size, Chemical Analysis, Shrinkage. C. D. Galloway, III, Ductile Iron for Heavy Machinery. *Iron Age*, vol. 166, August 1950, pp. 75-78.

The use of ductile iron for machinery castings weighing up to 30 tons is described. A table showing how the mechanical properties differ with section size varying from 1 to 36 in. is included along with two photomicrographs illustrating the change in structure with a small modification in the chemical analysis. Shrinkage comparisons between gray iron and spheroidal iron castings indicate that cast iron patterns can be used for ductile iron.

Cast Nodular Iron in Thin Sections

106—Develop Special Anneal. E. J. Laufer, "Ductile Iron—in Light Sections," *Iron Age*, vol. 166, Aug. 1950, pp. 79-82.

Production of thin-sectioned castings with cross sections as low as $\frac{3}{32}$ in. and weighing as little as $\frac{1}{3}$ oz. in ductile iron is described. Due to the high mold cooling rate, the parts in the as-cast condition have little ductility. A special annealing cycle requiring a total time of 24 hr in the furnace has been developed.

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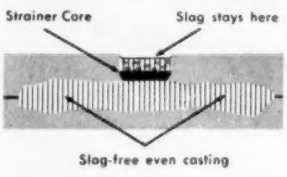

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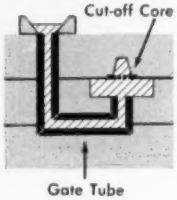

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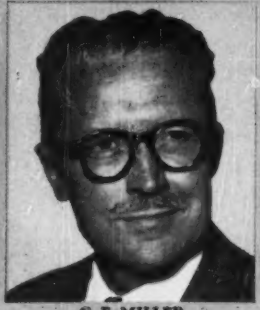

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